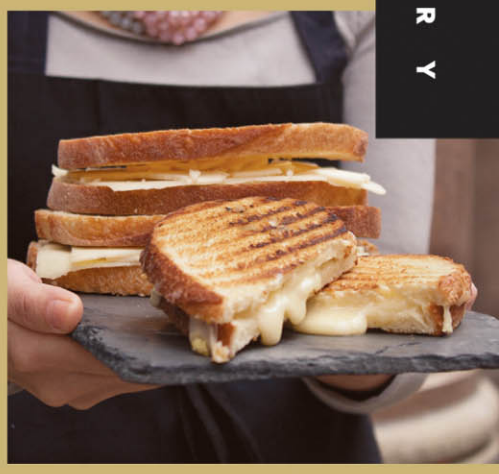
AN INSIDER'S GUIDE TO THE ART AND CRAFT OF HOMEMADE ARTISAN CHEESE, TAUGHT BY THE MASTERS

THE CHEESEMAKER'S APPRENTICE

SASHA DAVIES
WITH DAVID BLECKMANN



QUARRY

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Alyce Birchenough adds cultures to the vat starting the cheese-making process.

FOREWORD

ALYCE BIRCHENOUGH, SWEET HOME FARM, ELBERTA, ALABAMA, USA

One of my chores as a six-year-old growing up in the 1950s in New Orleans was to go to the grocery next door to shop for my mother. On one memorable trip, I spied something that would change my life. Sitting next to the cash register were two glass bottles of spoiled milk. That cream-line milk had been contaminated with what I now know to be spoilage bacteria that had made it foam and clabber and pop its cardboard cap off. In my mind's eye I can still see that 2-inch [5 cm] column of clabbered cream rising out of that bottle, seemingly suspended in midair. I never forgot that sight or stopped wondering how that happened.

Fast-forward to my college years, when some dorm mates of Italian heritage assured me that cheese making was quite a simple task of boiling milk and adding some vinegar. Equipped with a hot plate,

reconstituted powdered milk, and a bottle of vinegar, I set to work and in short order had an inglorious small lump of rubbery cheese. After sprinkling it with salt, I set it in the refrigerator to age for a few days before tasting it. Its bland and uninteresting flavor proved there was obviously more to this than I thought.

A few years later, in the early 1970s, I found a cheese-making kit complete with ingredients and a mold. I spent a lazy Saturday afternoon carefully following the enclosed Cheddar recipe and placing that tiny wheel in the refrigerator to age. A few short days later, my little masterpiece was cracked and riddled with mold. Disappointment again! I set aside my cheese-making curiosity for a few more years. When my soon-to-be husband and I started homesteading in western Michigan a few years later, he dutifully asked me what I would like for a wedding present. Without hesitation I asked for a dairy cow.

Cindy Lou, a matronly Guernsey of seven years, arrived just minutes prior to the start of our wedding reception. To our astonishment, her bulging udder responded generously to our fumbling hands and quickly filled a 3-gallon [11.4 L] pail to the brim!

Alyce Birchenough gently fills forms set along the draining table with fresh curds.

And so began our crash course in home dairying. Without much information available on home dairy processing, we began improvising. Our hand-churned buttermilk and yogurt served as cultures with junket tablets from the grocery as a coagulant. An enameled canning kettle became our first cheese vat. Cheese-making recipes were gleaned from Carla Emery's *Encyclopedia of Country Living*. Homemade wooden molds with iron press weights were fashioned. Paraffin melted with crayons was pressed into service as cheese wax. An old pie safe in the cellar took on a new role as "cheese cave." So for quite a while and through lots of missteps, we, the pigs, and the chickens ate well.

Through trial and error, the ever-improving cheese we served to friends and family soon became a sought-after treat. Then, someone offered to purchase cheese and the proverbial lightbulb went on in our heads. Shortly thereafter, the New England Cheesemaking Supply Company and the American Cheese Society [ACS] were born, creating an artisan cheese community and access to real information. Meeting so many like-minded folks at the first ACS meeting gave us the inspiration we needed to forge ahead toward a commercial operation.

Growing increasingly frustrated with our cold climate and local bureaucracy, in 1984 we made an impetuous move a thousand miles south to the Gulf Coast so the cows could access year-round pastures. Undeterred by our lack of financing and spurred on by our youthful, naive enthusiasm, we focused on making our dream of running a farmstead creamery come true.

In two more years we had built our creamery using the model from the Minnesota Farmstead Cheese Project workbook. Now, thirty-plus years since purchasing our first cow, I am still in awe of the cheese-making process. Our farmstead dairy provides us with a sustainable income and an exceptionally rewarding lifestyle. Each vat speaks to me in a different way, offering up its mysteries slowly as I use my cumulative skills to coax the expression of soil, grass, animal, climate, and season from each batch.

Now there's easy access to professional-quality information, supplies, and ingredients; business models, educational opportunities, and mentors abound. Thinking of navigating the risks and rewards of joining the community of impassioned cheesemakers? Then let Sasha Davies, with her reverence and knowledge of cheese and cheesemakers, guide you through a captivating journey of creativity and good eating.

—Alyce Birchenough

Alyce Birchenough owns and operates Sweet Home Farm, a small farmstead dairy, in Alabama with her husband, Doug Wolbert. She has been learning about and making cheese for more than thirty years—an exceptional accomplishment particularly because when she started there weren't any real resources, let alone technical assistance, for small-scale cheesemakers in the United States. Through the decades Alyce has opened her cheese room and offered support to myriad beginning cheesemakers, retailers, distributors, and writers on the subject of cheese and cheese making. The majority of cheesemakers in the southern United States, and even a few along the eastern seaboard, credit her as their best resource when they were learning to make cheese.

Sweet Home Farm's cheeses have won awards at the American Cheese Society and been honored by Slow Food as examples of quality, traditional cheese making. Alyce has contributed significantly over the years to the Raw Milk Cheesemakers' Association, the American Cheese Society, and Slow Food.

A feast of cheese, wine, and accompaniments

INTRODUCTION

A few things I've observed in my time working behind a cheese counter: The majority of people approaching you are smiling; a lot of the customers you help are convinced that your job is the best job there is; *and* many of these happy, cheese-loving people don't know much at all about how cheese is made. Understanding cheese making is an absolute necessity for anyone interested in becoming a cheesemaker, but it is nearly as important for cheese professionals and consumers. A firm grasp on cheese making will aid professionals and enthusiasts alike in identifying, evaluating, describing, and understanding the food that they love so much.

While one is enjoying a ripe hunk of cheese alongside toothsome baguette slices, fresh fruits, and a chilled glass of white wine, it can be a stretch to remember that cheese is a food of humble and practical beginnings. Cheese was a response to the need to preserve the nutrition encapsulated in milk so that it would not be lost to spoilage. Prior to the days of refrigeration, preserving food was a necessity to ensure that food would be available long after the growing season and subsequent harvest was over. In some ways, because cheese was born of necessity, there was a tendency to consider it a food of the peasants.

Cheese was likely a serendipitous discovery by travelers who filled bags made from animal stomachs with milk for their journey. When they arrived at their destination, they discovered a substance that had separated into loose, lumpy solids and a thin liquid. The specific science of this process has been continually unraveling ever since, but this kernel of knowledge was incredibly powerful because humans at that time already understood that foods with a lot of moisture could not last for long periods of time. They had stumbled upon a method of preserving milk that would allow it to be stored and even transported safely.

An entire universe of textures, techniques, flavors, and shapes has emerged in cheese since that early revelation. Every day that I spend in the cheese industry evaluating, describing, tasting, and selling cheese, I have at least one moment of astonishment that such diversity can be achieved using the same basic ingredients. This is not dissimilar to how appreciators of wine, beer, or bread must feel about the objects of their affections. All of these foods—cheese, beer, wine, and bread—start with the same basic ingredients, and with the addition of craftsmanship, science, and carefully honed techniques, those ingredients are transformed into a spectacular range of products.

A lovely Nubian doe at Goat Lady Dairy in North Carolina demonstrates the curious and friendly nature that makes goats a popular choice for farmstead cheesemakers.

Beecher's Handmade Cheese in New York City draws crowds of passersby with delectable grilled cheese sandwiches made with its signature Flagship cheese.

Beyond engaging us as a standalone food or ingredient, cheese connects us to the land and also to animals. This connection to the animals is all the more captivating because it extends the relationship between a herdsman and his or her herd; milk can be harvested from an animal repeatedly for a period after each time the animal gives birth, compared with, say, meat, which can only be harvested once. So cheese is a magical intersection of land, animals, and people.

Cheese-making operations were, and still are in many less-developed parts of the world, generally of a very small scale where a family farm milked anywhere from one to forty cows or herdsmen pooled milk from their flocks of sheep to produce cheese. The rise of the industrial revolution in food and the spread of refrigeration not only allowed but also encouraged dairy farms and cheesemakers to scale up and in many cases to consolidate operations.

In the past thirty years, the benefits of cheese making have expanded in developed countries from providing a method of preserving food to being a vehicle for securing land for agricultural use. The cultural and emotional attachment to traditional cheeses throughout Europe has helped to protect dairying practices and landscapes, and in the U.S., specialty cheese has become a value-added proposition in times when milk prices have hit historic lows. The specialty or artisan cheese movement goes hand in hand with the resurgence of interest in regional foods and food production. Culturally we have also expanded our concept of cheese to accept it as a slice in a sandwich, a garnish for soup, a powdered coating for crackers and chips, and the finale to an awe-inspiring five-course meal in the most highly lauded restaurants.

This book is for those who appreciate cheese as a food, and as an expression of culture, landscape, and our relationship to the natural world. I have surveyed experts in all aspects of the industry to highlight the decisions cheesemakers face. Having observed many dairy farms and cheese-making facilities, I can attest to the fact that there are an infinite number of approaches in this profession and no shortage of passion and enthusiasm for the end results. The goal here is to arm you with the information and encouragement you need to participate in the age-old art (and science) of transforming milk into cheese in your very own kitchen.

A BRIEF NOTE ABOUT EXPECTATIONS

There are two types of DIY people: those who are die-hard fans of the thing they set out to make, and those who are curious about the process. I would venture a guess that the latter group has more fun in their hand-made exploits because they have only a foggy focus on the end result. Adventures in cheese making can be pleasurable or painful depending on your expectations—not so different from any of life's endeavors.

A friend of mine once said, "It's easy to make beer at home; it's very difficult to make good beer at home." I maintain the same holds for cheese. The first time I ladled pillowy clouds of ricotta out of a pot, I was surprised and delighted to discover that it was good enough to eat because it had never occurred to me that cheese was something I could make in my very average kitchen. I didn't expect it to be edible, let alone delicious, and because of that was overjoyed with the results.

I have no intention of squelching anyone's enthusiasm. Considering the conversations I've had with cheese-makers in the writing of this book, it seems worth mentioning that making cheese is both incredibly simple and difficult; I tell you this in hopes of alleviating some of the pressure. If you can manage to divorce yourself from the idea that you're going to make cheeses that taste like your favorite store-bought fromage—at least without a lot of practice—and instead revel in the discovery of the process, there is endless potential for enjoyment in home cheese making.

CHAPTER 1: THE CHEESEMAKER'S TAXONOMY AND THE BASICS OF CHEESE

There are numerous systems for classifying cheeses, and all are imperfect. This book provides you with two useful systems for identifying and categorizing cheeses, and when used together these classification systems offer a more complete picture of what to expect from a cheese in texture and flavor. The first system relies almost completely on texture and the second focuses on the type of rind.

These two approaches identify terminology that most people use when they describe cheese—very useful information for cheesemakers when conducting market research for new cheese development or trying to describe existing cheeses to consumers. In addition to providing a common language, combining these sets of terms also tells us quite a bit about the techniques involved in making a cheese. There are endless pairings of these two sets of terms; for example, it is possible to have a soft cheese with a leaf-wrapped rind and a blue cheese with a leaf-wrapped rind.

CHEESE STYLES

The terms here tell you about what is happening on the inside of a cheese. They describe the moisture content and texture with the exception of the term *blue*, which refers to the mold developing throughout the interior. The softer a cheese, the more moisture it contains. Cheeses with a firmer paste are made with curd that has generally been manipulated more through cutting, cooking, stirring, or pressing to help extract more moisture.

SOFT

This category is all about cheeses that have a lot of moisture. If a cheese is spreadable, it belongs in this category. Some of the cheeses in this category do not have any form of a rind, such as chèvre or fromage blanc. The fact that they have a lot of moisture makes these cheeses a perfect environment for microbes to be very active, so they tend to age quickly and have a shorter shelf life than aged cheeses. Examples: Chèvre, Ricotta, and Triple Creams

With its plethora of colors, textures, and shapes, cheese captures the imagination and stimulates appetites.

Tasting a wide range of styles in one sitting is one of the many benefits of enjoying cheese with a large group of friends.

SEMISOFT

These cheeses are the middle ground between a paste that is uniformly soft and one that is uniformly firm. Some cheeses in this group have a textural combo, such as Camembert, for example, in which the bit right beneath the rind can become quite soft but the center can have a firmer, cakey quality. Others maintain a more uniform texture throughout that is pliable; if you pressed on the wheel, there would be some give. Examples: Saint Nectaire, Grayson, Brie, Mt. Tam

FIRM

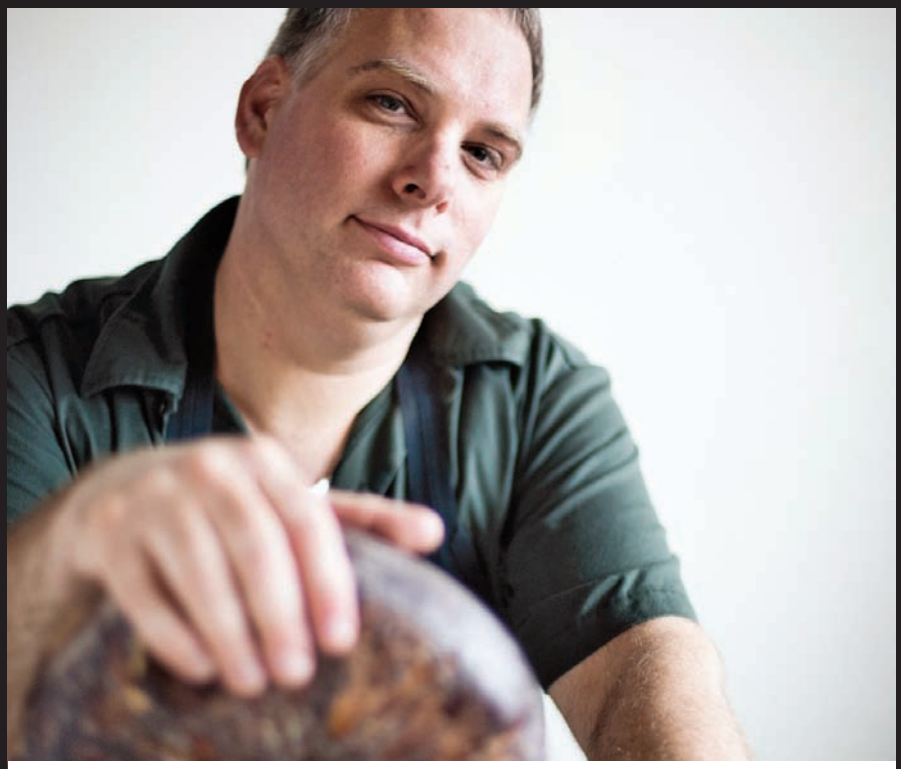
Cheeses in this category tend to have a denser paste that can be slightly fudgy—thick but yielding. The process for making these cheeses includes techniques that extract more moisture from the curds, such as cutting curds smaller, stirring, cooking, and pressing. Examples: Clothbound Cheddar, Comté, Pleasant Ridge Reserve

HARD

Although these cheeses harden during aging, their fate is set during cheese making by removing even more liquid from the curds. The techniques are even more extreme than those used to make firm cheeses. Curds can be cut even smaller, cooked and stirred, pressed at higher pressure, or aged for longer periods of time. Examples: Parmigiano Reggiano, Dry Jack, Aged Gouda

BLUE

These are cheeses that have blue molds growing throughout their interiors. Contrary to popular belief, these molds are not injected into finished wheels; rather, they are added to the milk during cheese making. Blue molds are aerobic, meaning that they require oxygen to flourish, so after wheels are unhooped and brined they are pierced to allow air inside. Examples: Stilton, Roquefort, Gorgonzola, Rogue River Blue



Cheesemonger Gordon Edgar leans on one of his favorite iconic California cheeses, Vella Dry Jack. Photo: Myleen Hollero

GORDON EDGAR,
RETAILER, RAINBOW FOODS COOP, SAN FRANCISCO, CALIFORNIA, USA

Gordon Edgar started at Rainbow Foods Cooperative in San Franscisco in 1994. Over the course of seventeen years, along with his coworkers, he transformed two reach-in refrigerators filled with basic cheeses—Cheddar, Jack, cream cheese—into a robust cheese counter that rivals any dedicated cheese shop in the country. His book, *Cheesemonger: A Life on the Wedge*, is a revelatory read about his "coming of age" in the cheese industry, which he parallels to the punk rock scene, and his experience working in the cooperative. Edgar has become an important (and ever-candid) voice in the industry.

IS IT IMPORTANT FOR A RETAILER TO UNDERSTAND CHEESE MAKING?

It's important to have a general sense of how different cheeses are made. On one level it's about groupings of cheese; if somebody comes in and asks for one type of cheese and you don't have it, you have to know what's going to be similar, and often that has to do with the way cheeses are made. Customers just want to know what it tastes like and what it does, but knowing how cheese is made will help you figure out what to give a customer who is looking for something you don't have. The other reason is to make sure that your different categories are covered—you're not missing washed rind cow's milk cheese.

It's hard to explain to customers why cheeses taste different from each other unless you have some sense of how they are made. You don't need to know the pH level or how long the curds were sitting in the tank or any of that stuff that's supertechnical, but you have to know why the top of that cheese is pink or why that one has holes and this one doesn't. Those are the basic questions you get every day in retail; if you don't know how cheese is made, then you won't know how to answer those questions.

HOW DID YOU LEARN ABOUT CHEESE MAKING?

I learned most of it from a combination of some initial visits to cheese plants to get a sense of what was going on and what people do, and going to workshops that were intended more for cheesemakers than for retailers or consumers and listening. Just listening and seeing what people are talking about—and then figuring out what issues are for cheesemakers on a make process level—will give you a lot of insight into how cheese is made.

AS A RETAILER, WHEN YOU EVALUATE A CHEESE, WHAT DO YOU LOOK FOR?

When I'm evaluating to see if I'm going to sell it at the store, I look for two things. For bringing a new cheese into the store (we have an established cheese department, so we kind of have our bases covered), it has to have something extra going for it; it has to be either better than something we already have in the case or have a unique enough story—organic, locally produced, those kinds of things. Before I even taste it, I'd be thinking about those questions.

When tasting, I look for good qualities and I look for defects. If I put it in my mouth and it has this taste of something that's incredibly satisfying or incredibly interesting, then that's something I'm definitely going to think about how I can work it into the case. If it has obvious defects, clearly that's a problem. If it tastes bitter, if the rind looks cracked and not cared for well, or if it's got off-tastes, then I'm not going to buy it.

WHAT'S THE MOST COMMON CHEESE QUESTION YOU GET?

In our store it's probably whether a cheese is raw or pasteurized and whether a cheese is animal or vegetable rennet. But I think the rennet question is specific to us because we don't carry meat or fish in the store, so we have a huge vegetarian clientele; I can imagine that's a nonissue in many places.

DO YOU MAKE CHEESE AT HOME?

I have once or twice, but I'm better at selling cheese than making cheese.

DO PEOPLE ASSUME THAT YOU MAKE CHEESE?

It's funny, five years ago—even at a hippie store like ours where people are doing a lot of do-it-yourself projects and doing a lot of gardening and making a lot of their own food and pickling their own food and all that kind of stuff—no one asked about cheese making. Maybe one or two people a year asked about cheese making; now it's an everyday question.

HOW DO YOU FEEL ABOUT CHEESE CLASSIFICATION SYSTEMS?

Cheese classification systems have their place, but they are different for different groups. If you're a professional and you're judging cheese, you can be very specific and technical with your cheese categories, and you should be because that's basically what the question is (How well did somebody make cheese of this style?). If I'm a retailer talking to a customer, I'm not going to get into the category thing that I would get into as a judge because very few people care.

Usually it's, "I have a cheese plate. What kind of cheese should I buy?" For customers it is, "Is it soft, is it semisoft, is it hard, is it runny, is it stinky, or is it blue?" Those are pretty much the only things people want to know. It's my job as a cheesemonger to know technically what categories cheeses are but then translate that for the average customer who has no need to know that. If they have their own curiosity, I'm happy to go there with them, but in order to enjoy cheese you don't have to know which classical category it fits into.

HOW DID YOU DEVELOP YOUR PALATE FOR TASTING CHEESE?

I had no formal training whatsoever; I don't know what formal training would entail. I think most people in retail are making the best of the situation they're in—most people kind of fell into cheese and then had to figure out what to do about it.

We have a rule in our department, especially when people are training, which is just taste *everything*. It doesn't matter if somebody has already tasted it and you know it's good, or it's commodity and you know it's always going to be the same—you taste everything and you realize what tastes like what and what doesn't taste like what. When something is a little different, talk about it with your coworkers and see what they think. I've never gone through a formal program; for me it was just comparison, talking to people, and then reading books—because I didn't have a word for what Emmental is supposed to taste like (oh, *nutty*), and I'm still a little unclear about what *piquant* means, to tell you the truth.

It's hard to explain to customers why cheeses taste different from each other unless you have some sense of how they are made.

WHAT IS THE MOST IMPORTANT YET OVERLOOKED SKILL IN YOUR PROFESSION?

God, there are so many! Number one is basic food handling, sanitation skills—nobody ever mentions this. While I think once you get the basics down you kind of got 'em down, it is overlooked because it's not a very sexy topic. But that really is number one for me. You can't even start talking about the difference between a Comté and a Swiss Gruyère until you know how to [expletive] wash your hands. That's number one.

Number two is keeping an open mind—because you can learn all these things, but the cheese landscape changes. Ten years ago you could make some sweeping generalizations about U.S.-made cheese and European cheese and I'd say that now a lot of those are invalid or totally different. You don't have to be super trendy, you don't have to jump on everything, but you've got to keep an eye on how things are.

TYPES OF RINDS

The majority of aged cheeses have some form of rind. Fresh cheeses often do not have rinds; for example, ricotta and mozzarella do not have outer surfaces that are distinct from their interiors.

There are ten basic rind types and, of course, infinite combinations of these types. For instance, there are cheeses that are washed for a couple weeks before being allowed to develop a surface-ripened rind. In describing a cheese by its rind, you are referring to the end result, not to processes used throughout its development.

Camembert, Comté, and walnuts

CLOTHBOUND

This type of rind is achieved by wrapping wheels in cheesecloth or butter muslin at some point during aging. Originally this was done largely as a pest prevention measure; now it is done to achieve a specific texture within the cheese and also for aesthetic reasons. The cloth protects the cheese's exterior but is breathable and allows moisture to escape. Prior to being wrapped, wheels are painted or rubbed with lard or another kind of oil to moisturize the rind and help the cloth adhere to the cheese. Example: Clothbound Cheddar

FLAVORED

A flavored rind is one in which herbs or spices, or both, have been used to coat the cheese and develop a rind of sorts. This can be done with fresh cheeses designed to be eaten days after their production and also to wheels that age for months.
Examples: Tomme de Bordeaux, Fleur du Maquis, Barely Buzzed

LEAF-WRAPPED

These cheeses are wrapped in a leaf or leaves either when they are fresh or after they've been allowed to develop a bit of a skin. The leaves protect the cheese from rapid moisture loss and potentially unwanted molds. Leaves can also impart flavor to the paste, especially if they have been macerated in spirits, such as brandy, before being applied to the cheese, as is the case with Rogue River Blue.
Examples: Hoja Santa, Banon, Valdeon

NATURAL

Natural rinds are just that—rinds that are allowed to develop naturally. The cheesemaker doesn't apply anything to block rind development (such as wax or plastic). Natural does not mean unintentional, though; cheesemakers can add bacteria to the milk or expose freshly made wheels to bacteria that they would like to develop on the rind. Cheeses with natural rinds can vary in color from mottled white and gray to any shade of brown. Examples: Garrotxa, Caerphilly, Ascutney Mountain

PLASTIC

Cheeses with this type of "rind" are actually aged in Cryovac packaging. Packaging cheeses in this way involves placing them in a thick plastic bag and then sucking out all the air in the bag before sealing it. Cheeses are then kept in a refrigerated room for weeks or months and allowed to age. The primary advantage of this process for a cheesemaker is that no moisture is lost during the aging process; this means more cheese to sell but also that cheeses can be aged longer without becoming dry or damaged. This type of aging also yields a specific kind of texture that is firm yet moist, making these cheeses feel almost creamy on the palate. Examples: Cheddar, Gouda, Havarti

SMOKED

All sorts of cheeses can be smoked, but those considered to have a smoked rind are ones that have a tan or brownish exterior that is the result of smoking. Examples: Smoked Gouda, Cheddar, Mozzarella

SURFACE-RIPENED

These cheeses have had some kind of mold or bacteria either added to the milk or sprayed onto the surface. There are two big classes of mold/bacteria used that produce a different look on the rind. Many cheesemakers use multiple molds/bacteria in developing their rinds, so at times it can be tricky to distinguish these rinds from one another. The three groups defined below—bloomy, *Geotrichum*, and washed or smear-ripened—outline the primary mold/bacteria and the kinds of rinds they develop.

In describing a cheese by its rind, you are referring to the end result, not to processes used throughout its development.

Bloomy

White, fluffy rinds resembling cotton are called bloomy rinds. The primary microbe causing the rind to "bloom" is a species of *Penicillium*, usually *P. candidum*. A cheesemaker achieves this type of rind by adding a strain of *P. candidum* to the milk and then creating the right conditions to foster development of the rind—low acidity, briny, slightly dry—followed by consistent humidity. These microbes are aerobic, so they can only grow on the outside of the cheese, where there is oxygen available. While developing the white rind, these bacteria are also helping to break down fats and proteins within the paste, ripening the cheese from the outside in. Examples: Mt. Tam, Brillat Savarin, Brie

Geotrichum

These cheeses are often described as brain-like in appearance because their rind looks somewhat thin and is wrinkled and wavy. This type of rind is primarily developed by aerobic microbe called *Geotrichum candidum* (Geo). Geo acts in much the same way as *P. candidum*, growing a skin around the exterior of the cheese and then breaking down the paste beneath, releasing flavors and altering the texture as it goes. Examples: Bonne Bouche, Chevrot, Valençay

Washed or Smear-Ripened

Washed rind is a tricky term because many cheeses are washed at some point during their development, either to prevent specific molds from developing or to keep rinds moist and supple, preventing cracking. However, when people request a washed rind cheese, they are generally looking for a gooey cheese that smells somewhat like dirty socks and has a robust, even pungent flavor.

The washing is done with a brush or cloth, and the wash is usually a briny solution. Bacterium called *Brevibacterium linens* or similar species is responsible for the rusty orange hue that develops on these rinds. The more moisture a cheese has, the more quickly any bacteria contained in the wash (e.g., *B. linens*) will work on breaking down the paste of the cheese. If a brine wash is used on the outside of a cheese with less moisture, the effect will mostly be to keep the rind from cracking and to prevent the growth of unwanted bacteria during the longer aging period.

Washing can also be done with beer or spirits. These liquids impart a modest amount of flavor to the paste, but the intensity of that flavor depends greatly on the quantity used and the length of aging. Examples: Limburger, Epoisses, Red Hawk, Taleggio

WAXED

These cheeses are dipped in melted wax at some stage in their development to prevent the growth of mold on the exterior. Wax also helps hold in moisture during aging. Examples: Gouda, Edam

Rachel Dutton (right) at work in her mobile lab in the Cellars at Jasper Hill, Greensboro, Vermont

RACHEL DUTTON,
MICROBIOLOGIST, HARVARD UNIVERSITY, CAMBRIDGE, MASSACHUSETTS, USA

Rachel Dutton's discovery of microbes—microbes that had only ever been identified in the Arctic Ocean—on the rind of a cheese made in northeastern Vermont caught the industry's attention. An accomplished microbiologist and Ph.D. candidate at Harvard University, she is currently researching microbial communities that make up cheese rinds as a model for the interactions in microbial communities in the natural world. Her work will undoubtedly have a lasting impact on the way we understand and describe cheese rinds.

There is a lot of important research done on food science in terms of safety, quality, and consistency of foods—but not from the standpoint of thinking that we could learn something new about microbes themselves.

TELL ME A BIT ABOUT YOUR AREA OF STUDY.

My background is in studying bacterial genetics of a single species at a time. There's more going on in terms of the biology that microbes carry out when they are in a natural setting surrounded by many other species compared to when they're growing in isolation in the lab. I wanted to understand microbial communities and what microbes are doing out in the real world.

I was reading Harold McGee's book on food science, *On Food and Cooking*, and realized that there was a lot of interesting microbiology in food that people weren't studying from the perspective of a biologist. There is a lot of important research done on food science in terms of safety, quality, and consistency of foods—but not from the standpoint of thinking that we could learn something new about microbes themselves using food as a model for understanding how microbes live.

DID CHEESE EMERGE AS A NATURAL CANDIDATE FOR YOUR RESEARCH?

There are a lot of fermented foods—yogurt, beer, wine, and bread—that are interesting but not very complex, with maybe one or two or three species [of bacteria] that are important for the fermentation. I bought some cheeses to do a tasting, and looking at the rinds I thought, there's so much going on here that we don't know about. It's a fascinating community with attributes that you would want out of a model system for understanding microbial communities.

HOW MUCH DID YOU NEED TO LEARN ABOUT CHEESE MAKING TO BE EFFECTIVE IN YOUR RESEARCH?

Before I started my position here, I spent two months at Jasper Hill making cheese. I made cheese with them and I was in the Cellars helping age cheeses—a total joy for me. Being in the Cellars is like going to the zoo if you're a microbiologist. It's fascinating to be that close to microbes that you can see developing.

I felt that having a good basic knowledge of how cheese is made, the important steps in producing cheese, and where cheese can go wrong would be helpful for me in understanding what the microbes might be experiencing in different situations.

IS ANYONE ELSE IN THE WORLD DOING SIMILAR RESEARCH?

There is not that much research on the basic microbiology of cheese, probably because there's not much funding to do this type of research. There is funding to do research on pathogens that might be found in cheese or research from a public safety angle, but there's not a lot of funding for *basic* research on anything, so I'm fortunate to have this opportunity.

DO MICROBES GROW AND DEVELOP DIFFERENTLY?

Absolutely. Every species on the planet is different—all have different growth requirements, prefer to feed on different things, or prefer to be in different types of environments. Something like *Brevibacterium* is different from *Geotrichum*, for example—*Geotrichum* is a filamentous fungi, and *Brevibacterium* is a bacterium. *Brevibacterium* can thrive in high-salt environments. When you wash a cheese with a brine solution, you're creating an environment on the surface of the cheese where only organisms that can thrive in that sort of environment will live. *Geotrichum* has a relatively low salt tolerance; it didn't evolve to live in salty environments, so it doesn't thrive on those types of cheeses as well as something like *Brevibacterium* does.

They all have things that they like, and they're all contributing different things to the cheese. Maybe they're producing a lot of proteases that break down the protein, but they are doing it in different ways or with different types of enzymes.

DO THE CULTURES ADDED DURING CHEESE MAKING SHOW UP ON THE RINDS OF THE CHEESES?

It depends on the cheese. It's pretty clear with bloomy rind cheeses; you add *Penicillium*, you get *Penicillium* on the surface. That's because you're creating just the right environment for those species and inoculating them at high levels, so there is not a lot of competition from other organisms that might be around sort of natively in the environment.

For a washed rind cheese—there have been studies about this in France and Germany—people add *Brevibacterium* (because that's what is supposed to be on a washed rind cheese) and then don't end up finding *Brevibacterium* on the cheese. They find other species that probably have similar characteristics to *Brevibacterium*, but they are whatever is present locally—different species of *Corynebacterium* or *Arthrobacter*, native *Brevibacterium* species, or others that are naturally selected out of the environment for their ability to thrive in that condition of high salt and high moisture on the surface of cheese.

WHY IS CHEESE AN IDEAL MICROBIAL COMMUNITY FOR OBSERVATION?

You can watch it form over time, right in front of your eyes, as the cheese ages.

It's reproducible, at least within a batch of cheese. Wheels progress similarly, along the same time frame, and end up similar products.

The system is simple compared with other communities, but it has an interesting mix of organisms. Bacteria *and* fungi live there, so you can see interactions between two different domains of life.

There are interesting variations on the theme. You can understand something about microbial communities studying natural rind cheeses and something different studying washed or bloomy rind cheeses.

ARE YOU SURPRISED THAT CHEESEMAKERS DON'T HAVE A FIRM GRASP ON THE MICROBIOLOGY OF RINDS AND YET THEY HAVE REASONABLE DEGREES OF SUCCESS?

Cheese is a traditional food, and people have been figuring out how to make it for thousands of years, so all of this traditional knowledge has been passed down and we know that if you do X, Y, and Z when you age a cheese you're probably going to end up with something similar to something somebody's made before. Even so, we do a lot of work at Jasper Hill, and there are constant issues they run into in aging cheeses where they don't know what's going on. Something happens that's not the way it's supposed to go, and it's hard to know how to fix the problem when you don't know what's causing it. I find it surprising that we don't know more about the food that we eat in general—not just cheese.

HAVE YOU IDENTIFIED MICROBES THAT EXIST IN MILK PRIOR TO CHEESE MAKING TO SEE IF THEY PERSIST IN THE FINISHED CHEESES?

The first step is just figuring out who is there. We don't really know how many different species are present, who they are, how different it is from one different rind type to another, or how different it is from the same type of rind but made in a different location. There are a lot of open questions about what these communities are made up of. Once you answer that question, you want to know what are they doing and where they came from.

IS THERE POTENTIAL FOR YOUR RESEARCH TO OVERLAP WITH RESEARCH BEING DONE ON TASTE AND TEXTURE IN CHEESE?

There is definitely potential there—a lot of the smell and taste of cheese is from the microbes that are growing there. We found a *Geotrichum* strain that we think came from Jasper Hill, not from a starter culture that they bought, and it could be interesting to see if that organism produces a different set of flavors.

HAVE YOU HAD ANY DISCOVERIES OF UNEXPECTED MICROBES?

We're picking up organisms that people have found in other environments but ones that have not necessarily been associated with food products before—probably because we haven't really looked.

WHERE DO THEY COME FROM?

They are in the environment. We don't know if they are growing in the soil, on the udders of the animals, or in the air; there are several sources where they could be growing when they're not growing in cheese. When cheese is made and aged, it's exposed to different environments. Organisms from those environments that can also thrive on the surface of cheese might end up growing on the cheese, producing a unique set of flavors and smells.

WE THINK THAT SAFE FOOD IS FREE OF UNFAMILIAR BACTERIA. THIS IDEA THAT THERE ARE ORGANISMS ON CHEESE THAT WE DON'T KNOW ABOUT OR HOW THEY GOT THERE SOUNDS KIND OF SCARY.

There are definitely things you don't want growing on cheese. It's a valid question: How do you encourage just the things that are helpful or benign and discourage things that you don't want growing on cheese? We're doing research in the lab with cultures we've isolated from cheeses to look at interactions between species, and we could find out that certain types of communities are very good at preventing invasion of certain pathogens.

One issue with harvesting native species versus inoculating—the idea of inoculating with standardized cultures is to have consistency in the product—is that we don't know how much seasonal variability there is in microbes present in the environment. Your cheese might taste slightly different, which is what we see anyway in cheeses—they taste slightly different from season to season, and maybe that's because you're having different species present. That could make cheeses more interesting in some ways, but it may not be what everybody wants.

BASIC MICROBE TERMINOLOGY

MICROBE

General term for any living organism that we can't see with our naked eyes. In cheese this refers to fungi and bacteria. Fungi are *eukaryotes*, and bacteria are *prokaryotes*—different branches on the tree of life.

FUNGI

There are two types of fungi—yeasts and filamentous fungi. Yeasts are single-cell fungi that give a sticky texture and bready smell to cheeses early in the ripening process. Filamentous fungi (a.k.a. molds) are fuzzy and grow on the surface of the cheese, like *Penicillium* on Camembert or brie.

BACTERIA

Single-cell organisms, usually much smaller than the fungi

Essential components of every cheese: milk, coagulant, culture, and salt

CHAPTER 2: INGREDIENTS AND EQUIPMENT

Although making cheese is distinctly different from cooking, there are similiarities between the two. For starters, identifying and using high-quality ingredients will generally yield a better end result, and understanding and preparing your equipment will minimize potential frustration during the process. As with any endeavor in the kitchen, there are nuances and insights that only come with time and practice, but reading the entire recipe, selecting proper ingredients, and setting up your work space with care before you get started will set you on a path to success.

INGREDIENTS

The quality of the raw ingredients going into a cheese directly correlates with that cheese's potential for greatness. Rapidly rising interest in home cheese making has helped to raise the bar for all of the main ingredients in cheese in terms of quality and availability. Family farms are bottling their own milk with less manipulation than large-scale processors, and cheese-making supply companies are willing to sell smaller quantities of the more specialized ingredients such as coagulants and cultures.

Cultures, salt, and coagulant/enzymes are the three ingredients you see listed after milk on artisan cheese labels. When the artisan cheese renaissance was beginning thirty years ago, it was difficult for small-scale cheesemakers to purchase nonindustrial quantities of any of these ingredients. Many of the early cheesemakers learned how to make and maintain their own cultures and coagulants. Most cheesemakers today do not make these ingredients, so part of their cheese-making obsession is figuring out where to get the most efficient, reliable, and cost-effective supply of each one.

Pour milk slowly and gently into your cheese-making pot to avoid aeration.

MILK

Nearly all cheesemakers agree that cheese making starts in the pastures because milk is the foundation of their business, and that the way dairy farmers feed and manage their animals greatly affects the quality of the milk. These two beliefs are almost universal, but that is where the agreement ends among cheesemakers. Each producer has a unique set of criteria for the milk they use in cheese making.

Female mammals produce milk for their offspring during the earliest stages of their lives. Initially milk is the sole food source for these animals, providing them with hydration, fats, proteins, and nutrients. There are three dairy species that are the primary sources of milk around the world: cows, sheep, and goats. Many other domesticated species—including camels, yaks, and water buffalo—are milked by humans and their milk is consumed, but in this book we are focusing on the most common species.

Milk varies greatly between these species and also between individual breeds within each of these species. The makeup of an animal's milk is influenced by genetics, available feed, environmental factors, and overall health. Ideal milk for cheese making has a high volume of solids (proteins, fats, and nutrients) because the primary goal in cheese making is to separate and capture solids (curds) from the liquid portion of milk (whey).

The largest of the three common species is the cow. Cow's milk is the most widely available because cows produce the highest volume per day, an average of 9 gallons (34 L). Cows also take up more space and require more feed than goats or sheep. The most popular breed of dairy cow is the Holstein with its large stature and iconic black-and-white spotted coat. Jersey cows are also quite well known for their pleasant disposition and the high fat content of their milk.

Beta-carotene is what makes cow's milk slightly yellow in comparison with sheep's and goat's milk. This is a pigment within fresh forage and is fat-soluble (carried by fat), so we see a range of color from cream (high-fat) to skim (low-fat or nonfat). Cow's milk makes nice firm curd that is easy to work with in cheese making. Common descriptors for cow's milk are buttery and slightly sweet.

Goats and sheep both produce significantly less milk than cows. Goat's milk has smaller fat globules than cow's and sheep's milk, and this makes it easier for some people to digest. Milk from goats is also almost naturally homogenized and cheeses made with it are generally softer, as a result, than those made from cow's milk. Common dairy goat breeds are Nubian, Saanen, and Alpine. There is a distinct "goaty" flavor in goat's milk that could be described as slightly earthy, and the milk is whiter in color than either cow's or sheep's milk.

One consideration with goats is that they can be slightly difficult to rotate through pastures because they don't technically graze; rather, they browse. This means they tend to eat things higher up off the ground, such as stripping bark from trees and removing all leaves from a shrub, and it can be challenging to ensure they get a balanced diet on pasture.

Sheep have a reputation for being somewhat fragile, and they also produce the lowest volume of milk; however, it is some of the finest milk for cheese making. Their milk has the highest butterfat and protein content of all three types, and this translates to a higher yield in cheese making.

One key benefit of sheep's milk is that it holds up better under freezing. This is important because sheep have a very short milking cycle and produce little milk, so the flexibility to store it and build up a supply is good. Sheep convert beta-carotene into vitamin A, so their milk is not as yellow as that from cows but is more of an off-white color. Common dairy sheep breeds are Friesian and Lacaune. Milk from sheep has a rich mouthfeel and a nutty sweetness, and it can also be a bit earthy in flavor.

Determining your milk source is the first step in making cheese. There are two basic models for acquiring milk: producing milk and purchasing milk. Should you decide to produce your own milk, you will have more control over the end result, but it means you also take responsibility for the care and welfare of a herd of animals and the land that supports them. Purchasing milk involves a different kind of work: identifying a source that meets your quality standards, is within a reasonable distance, and is allowed to sell milk to you.

Less common than Jerseys, Guernsey cows, also known for rich milk and their sweet disposition, graze on an open pasture at Sweet Home Farm in Alabama.

FACTORS TO CONSIDER WHEN LOOKING FOR MILK

The importance of working with high-quality milk in cheese making cannot be overstated, and yet there is not a universal definition of milk quality within the cheese industry. Although there aren't established standards, there are aspects of milk that most cheesemakers consider in making their evaluation.

Cleanliness

Clean milk is free of antibiotic residues, is not contaminated with pathogenic bacteria, and comes from healthy animals.

Flavor

At a minimum, a cheesemaker would be interested in milk that didn't have off-flavors and of course would prefer milk that tasted delicious. Taste, however, is subjective, and the flavor profile of milk is different depending on species (cow, goat, sheep) and also breed.

Components

Milk is made up of four basic components: water, proteins, fats, and minerals. Components are influenced by many factors including species, breed, feed, environment, stage in lactation cycle, and stress.

In cheese making, the ratio of protein to fat (often called butterfat) is important. This ratio affects cheese making; different ratios are better for making specific kinds of cheeses. For example, high fat content can work well with blue cheeses and many soft-ripened cheeses but can cause problems in certain pressed and cooked cheeses. Cheesemakers can make modest adjustments to the fat content by skimming the surface of the milk in the vat once it has settled. However, it is best to have the ratio of fat to protein remain as consistent as possible.

MILK TERMINOLOGY

Milk can be consumed straight from the animal with no adulteration, or it can be put through a variety of processes depending on who will consume it, and how it will be packaged, transported, and sold. The terms printed on the bottle or carton can tell you a lot about what the milk it contains has been through.

Raw

Milk that is not heat treated in any way is referred to as raw or unpasteurized milk. Naturally high in moisture, milk is a wonderful medium for bacteria. There are flavor-carrying bacteria naturally occurring in milk that add depth and complexity to cheeses made from raw milk. Concerns about raw milk stem from the potential for harmful bacteria to be introduced to the milk and thus into cheeses made from that milk. Note that this kind of contamination could happen to heat-treated milk too.

In the United States there is a federal regulation that dictates that all cheeses, domestic and imported, made from raw milk must be aged for a minimum of sixty days. This rule was established because of a belief that pathogenic bacteria could not survive in a cheese aged longer than that. Australia has banned cheeses made from raw milk completely, and Europe sits in the middle with many larger producers leaning toward pasteurization.

Pasteurized

Pasteurized milk has gone through a heat treatment process designed to kill any harmful bacteria that might be in it. The upside of this process is that it can reduce a specific risk; the downside is that the heat also kills naturally occurring bacteria that can be great contributors during cheese making.

There are a few legally accepted combinations of temperature and time that accomplish pasteurization. HTST (high temperature/short time) pasteurization is a process in which milk is brought up to a temperature of 161°F (72°C) for fifteen to twenty seconds. UP (ultra pasteurized) milk is taken up to a temperature above 172°F (78°C). Another option for fluid milk processors is UHT (ultra high temperature) processing, wherein the milk is heated to 275°F (135°C) for two to five seconds and then cooled.

Another, milder form of pasteurization is called LTLH (low temperature/long hold), which is often used by small cheesemakers. In this process, the milk is heated to 145°F (63°C) and held for at least thirty minutes. The lower the heat, the lower the impact on bacteria in the milk that might foster flavor and texture development.

Grass-fed/Pastured

These terms are not regulated, so they can mean a range of things depending on the farmer's interpretation. Generally, both grass-fed and pastured refer to the farmer's efforts to have his or her herds graze on pasture and for this to be a primary source of feed for the animals.

This does not mean that the animals are grazing on fresh pasture year-round. Most climates do not support year-round grazing. Instead, farmers may leave their animals on pasture but provide dry and/or fermented forage through winter or summer months when pastures are not in good condition. Most dairy animals also have their feed supplemented with some amount of grain because decades of breeding have encouraged these animals to produce higher volumes of milk, and their bodies are challenged to support that production solely on a diet of pasture.

Sheep line up to enter the milking parlor—looking forward to the bit of grain they get during milking—at 3-Corner Field Farm in New York.

Dr. Catherine Donnelly shows off a Cheddar carving at the University of Vermont. Photo: Cheryl Dorschner

CATHERINE DONNELLY, PH.D.,
PROFESSOR AND CODIRECTOR OF VERMONT INSTITUTE FOR ARTISAN CHEESE (VIAC), UNIVERSITY OF VERMONT, BURLINGTON, VERMONT, USA

An outspoken advocate for educating rather than increasing regulations for cheesemakers, Catherine Donnelly's work supports cheesemakers in producing artisan cheese safely whether they use raw or pasteurized milk. Donnelly is an expert on the general microbiological safety of foods and is recognized as an international expert on the bacterial pathogen *Listeria monocytogenes*.

Good cheesemakers spend as much or more time cleaning as they do cheese making.

HOW DID YOU BECOME SO INVOLVED IN THE RESEARCH AND CONVERSATIONS ABOUT RAW MILK CHEESE MAKING?

When I came to UVM in 1983, the first U.S. outbreak of listeriosis occurred in Boston—it was linked to pasteurized milk, and the source of the raw milk was dairy farms in Vermont. At that point no one knew about *Listeria* as a food-borne pathogen; there weren't methods to detect the organism. There had been veterinary research but never any good food science research. My lab developed some of the original detection mechanisms for *Listeria*; that started a line of inquiry that has lasted twenty-eight years.

In the late 1990s, the Cheese of Choice Coalition [CCC] wanted to hire me as a consultant to do a search and tell them if there were reasons to be concerned about the safety of raw milk cheeses. At the same time, cheesemakers in Vermont were not getting access to good scientific information, and we knew they needed help. So the CCC, our interest in *Listeria*, and the need to do something to help with safety converged, and Paul Kindstedt and I formed the Vermont Institute for Artisan Cheese.

There are two things you can do to affect safety: You can make up and enforce regulations, or you can educate people. We knew so much about *Listeria*—its control, and that cheese could be a source of *Listeria*—so I thought, let's pass on this educational information. Once people understand the risks they are trying to manage, they will be better prepared to make safer products—that's what has happened.

YOU ARE IN FAVOR OF TRAINING AND EDUCATING CHEESEMAKERS TO WORK SAFELY WITH RAW MILK RATHER THAN FORCING EVERYONE TO PASTEURIZE. WHY?

Listeria is an environmental pathogen—it lives in the environment of the dairy plant—so when cheeses are contaminated with *Listeria*, it's not that the organism necessarily originates in raw milk. Most studies over a period of years have confirmed products that harbor *Listeria* are becoming contaminated postpasteurization. If the risk is in your plant and you're not managing that environment, it doesn't matter if you're pasteurizing; those cheeses are going to still become contaminated by *Listeria* just like raw milk cheeses will.

If you look at the quality of raw milk used by most cheesemakers, especially those who have their own herds of animals and carefully manage them, the microbiological quality of that milk is incredibly high and it's used right away. Think about commodity milk production where you're commingling milk from many farms in huge volumes, trucking it, and pumping it in silos; the introduction of contamination in all those steps is higher than someone who collects milk from their animals at five in the morning and by seven o'clock it's in the vat making cheese.

FOR HOME CHEESEMAKERS STARTING TO MAKE CHEESE, WOULD YOU RECOMMEND USING RAW OR PASTEURIZED MILK?

It depends on the style of cheese. I would probably suggest that they start with pasteurized milk. My lab has just done a study of the quality of raw milk sold in retail establishments. We looked at its microbiological quality and did a shelf-life study. The keeping quality of raw milk is really short, and so even though it might be produced to a certain standard, a little more work needs to be done on shelf life. I don't know that a lot of states have really considered that, and that's what our cheesemakers know—most people making raw milk cheese are milking in the morning and using that milk right away; they're not giving it an opportunity to sit in refrigeration for days prior to cheese making.

IS POST-PRODUCTION THE REAL VULNERABILITY WITH PATHOGENS?

Post-process recontamination is a much larger factor in outbreaks than pathogens being present in raw milk and surviving the cheese-making process. One of the pathogens that the FDA was concerned about that led them to reexamine raw milk cheese safety was *E. coli* O157:H7. In data that we obtained from the FDA, over a three-year period they sampled about 3,300 different cheeses to test for that pathogen, and there were only three times when cheese was contaminated with that pathogen—not a strong case for the FDA to be basing its reevaluation of raw milk cheese safety.

Because there are a lot of published studies that *E. coli* O157:H7 can survive the sixty-day aging process, you can show theoretical survival. Sure, it can hang around for a long time, but the FDA's data would not suggest that it's a huge problem in commerce.

CAN YOU EXPLAIN THE THINKING THAT LED TO THE CURRENT SIXTY-DAY AGING RULE FOR ANY CHEESE PRODUCED WITH RAW MILK?

Back when that rule was promulgated, in 1948 or 1950, most of the cheese in the United States was Cheddar. *Salmonella* was a problem in the milk supply, and there were a few investigations that showed that if *Salmonella* was present in Cheddar when it was freshly made, holding that cheese for sixty days would allow the populations to decline. That was kind of where the sixty-day rule originated; it was focused on an aged cheese like Cheddar and a pathogen like *Salmonella*.

As time has gone on, that rule has been applied to many different cheese types and in some cases erroneously—people writing the regulations don't really understand the science. In the code of federal regulations in section 133, you can apply the sixty-day aging rule to a soft-ripened cheese. When we first started going out and working with cheesemakers, a number of them were making brie- or Camembert-style cheese and holding it for sixty days. Unlike a Cheddar, where over time the acidity, water activity, and all of the parameters chemically in that cheese create a microbiologically hostile environment so *Salmonella* dies, in a soft-ripened cheese like a brie that starts out on day one as pretty acidic, once the surface mold growth starts, you revert that pH from acidic to very basic. And if you've got a pathogen like *Listeria* in your aging environment and it gets onto that product, it's going to grow and spread like wildfire and actually be at its peak of risk after sixty days.

In France they understand this, and they don't permit AOC (raw milk) Camembert to be sold beyond fifty-seven days. Why? It's too risky. In the United States, we say hold it for sixty days and it will be fine and safe—it's based on no logic. That rule never should have been applied to soft-ripened cheeses. It just reflects that we still have a young cheese-making culture in this country.

IS IT FAIR TO SAY THAT IN WORKING WITH RAW MILK IN CHEESE MAKING THERE IS INHERENTLY AN INCREASED RISK?

Not necessarily. Look at France—their whole system of milk production for cheese making is based on hygiene. If you're going to make a raw milk cheese, you're going to have to comply with these incredible hygiene requirements for your milk; focus on the health of the animals, hygienic conditions on the farm, and the milk collection; and comply with rigorous microbiological criteria. We don't do that in the United States. Our whole system is: Produce lots of milk and pay attention to the quality but know that there's going to be a step called pasteurization that's going to help achieve that quality.

Good cheesemakers in this country are putting in place those strict hygienic standards for milk, and once you embrace that philosophy, then making cheese from raw milk is probably a lot safer than using commingled milk. What we're trying to do in this country is make raw milk cheese not respecting the stringent hygienic requirements that Europe establishes and instead following our own PMO (pasteurized milk ordinance) standards that are intended for milk that is going to be heat treated. We are choosing to do a hybrid, and there's no scientific rationale for that.

ARE THERE RELIABLE VISUAL CUES THAT WOULD LET YOU KNOW THAT A CHEESE HAS SOME SORT OF PATHOGENIC PROBLEM?

Probably not. In the case of *Listeria*, there's no off-smell, there's no off-taste—there aren't clues. Foods usually spoil before they have enough growth of a pathogen to make you sick. If something looks like it's at the end of its shelf life, you should chuck it.

THAT'S SOMETHING YOU'D ONLY DETECT THROUGH ENVIRONMENTAL OR PRODUCT TESTING?

Exactly. Good cheesemakers spend as much or more time cleaning as they do cheese making. The hygienic standards in a good cheese-making operation are really high—and if they're not, that's when you get into trouble.

The Centers for Disease Control and Prevention did a refrigerator study, and 20 percent of refrigerators from the homes where there were ill patients were contaminated with *Listeria*. How often do we clean and sanitize our refrigerators? Not often enough. If this is where you're going to age and store your cheese, you'd better apply those stringent standards that would be applied in an inspected cheese-making facility.

FINDING MILK IN THE SUPERMARKET

Depending on where you live, you may have access to raw fluid milk at supermarkets or health food stores in your area. In the United States, it is legal for retailers to sell raw milk in only a handful of states, so it is likely that you will be selecting from milks that have undergone at least pasteurization and probably also homogenization.

Milk that has been pasteurized at temperatures over 161°F (72°C) will likely be problematic for cheese making because that level of heat affects calcium distribution in the milk.

Most of the milk available in large supermarkets has also gone through homogenization. Processors force milk through a small nozzle at high pressure onto hard surfaces so that fat globules are broken down to a fraction of their normal size. The result is fluid milk with fat globules that are a uniform size and cannot bond to one another, rise to the top, and form a separate layer of cream. Although this is wonderful for ensuring that every glass of milk has the same, evenly distributed fat content, it yields a softer, weaker curd in cheese making and can cause difficulties in coagulation.

When fat globules are broken in homogenization, the fat is unprotected and is exposed to other enzymes within the milk that can split fats, further resulting in off-flavors. The fat-splitting enzymes are deactivated at high temperatures, making pasteurization a complementary process to homogenization.

ADJUSTING FOR PASTEURIZED AND/OR HOMOGENIZED MILK

Home cheesemakers can avoid homogenization by mixing nonfat milk and heavy cream (both are usually not homogenized) together to reach the same fat content in whole milk. The ratio is 1 pint (475 ml) of heavy cream for each gallon (4 L) of nonfat milk.

When shopping for milk for home cheese making, look for milk that is pasteurized at or below 161°F (72°C). Labels on the milk are relatively unreliable because they don't have to disclose the exact temperature of pasteurization and not all that are heated above 161°F (72°C) will be labeled *ultra pasteurized*. The only way to know for certain what temperature milk is pasteurized at is to contact the producer directly and ask. The website www.cheesemaking.com maintains a list of "good milks" that home cheesemakers around the country have identified as being pasteurized to levels that make it acceptable for cheese making.

If you are using store-bought milk and finding that your curds are too soft, you can try adding calcium chloride ($CaCl_2$) or slightly increase the amount of rennet. To use calcium chloride, dissolve in nonchlorinated water and add to milk prior to coagulation. Tap water in many municipalities is chlorinated to some degree. Chlorine can affect the functionality of certain coagulants, so it is best to stick with nonchlorinated or distilled water. If you are using tap water, you can neutralize the chlorine by adding a droplet of milk to the water before adding the calcium chloride or coagulant.

Combining cream and nonfat milk achieves the fat content of whole milk and avoids using anything that has been homogenized.

Calcium chloride can be purchased through any cheese-making supply company.

To create a 30 percent calcium chloride solution, dissolve 2 ounces (55 g) dry calcium chloride completely in 4 ounces (120 ml) of water. Then add additional water to make 6.4 ounces (190 ml) total solution.

HOW MUCH CHEESE YOUR CHOSEN MILK WILL YIELD

It takes a lot of milk to make cheese. The rule of thumb is, if you start with 10 pounds (4.5 kg) of milk for cheese making, you will end up with just 1 pound (455 g) of cheese and 9 pounds (4 kg) of whey. So even small differences in the components of an animal's milk can make a significant difference in yield. This chart offers average yields for cow's, sheep's, and goat's milks. Keep in mind that there can be considerable differences within a species depending on breed, and that environmental factors will also affect components within milk and thus yields.

Animal	Volume of Milk	Quantity of Cheese
Cow	1 gallon (4 L)	0.77 pound (350 g)
Goat	1 gallon (4 L)	1.2 pounds (540 g)
Sheep	1 gallon (4 L)	1.5 pounds (680 g)

CULTURES

This is a catchall term for crumbs, drops, or dust that is made up of molds, bacteria, or yeast. Packaged cultures come in plastic vials and sachets. The general functions of cultures are to develop acidity and to promote ripening. In cheese making there are two types of cultures: starter cultures and secondary cultures.

Starter cultures contain lactic bacteria similar to those that occur naturally in milk. The basic function of the starter culture is to perform lactic fermentation, to convert the sugar (lactose) in milk into lactic acid. Before cheesemakers could purchase starter cultures, they would hold milk or whey from the previous day's cheese making, allow it to build up a high population of lactic bacteria, and add that to the fresh milk in the vat.

Secondary cultures are made up of bacteria, molds, and yeasts that produce enzymes that act as catalysts in the transformation of the milk, curd and finished cheese. Through these actions they have the potential to alter flavor and texture. Usually added after the starter culture has had time to increase the acidity and prior to the addition of a coagulant, secondary cultures are often combinations of a variety of bacteria and/or molds that have specific tasks to trigger or accomplish during cheese making and/or aging, such as the development of a specific rind or the growth of blue veins throughout the paste. These secondary cultures require specific conditions (temperature, humidity, moisture content, salinity, acidity, etc.) in order to flourish and perform their desired functions.

COMMON SECONDARY CULTURES

Each of these secondary cultures comes in many varieties that may differ in the flavors they produce, the pace at which they develop, or the tolerance for specific environmental conditions such as the amount of salt present, temperature, or humidity. Some recipes are very specific in their cultures recommendations, but most will leave it to the cheesemaker to select the individual strain or combination of strains they use. Note that most suppliers are prepared to make recommendations specific to the results a cheesemaker wishes to achieve in their cheese.

Culture Name	Common Uses
Geotrichum candidum	Bacterium with yeast-like characteristics that helps develop wrinkly, skin-like rinds
Penicillium candidum	Develops white bloomy rinds. Used in brie-style cheeses and also in a variety of others.
Propionibacterium shermanii	Forms the eyes in mountain-style cheeses such as Emmentaler.
Penicillium roquefertii	Popular strain of blue mold named for one of the most famous blue cheeses, Roquefort.
Brevibacterium linens	Added to the milk or rubbed on cheeses after they have been formed to help develop orange-hued rinds and pungent aromas.

SELECTING THE RIGHT STARTER CULTURE

Selection of a starter culture is based on the style of cheese being made. Starter culture bacteria are classified into two categories: mesophillic and thermophillic. Mesophillic bacteria are active at lower temperatures (77°F to 86°F, or 25°C to 30°C) but become inactive over 104°F (40°C), so they would not be used in cheeses that require cooking. Thermophillic bacteria, as the name implies, are active at higher temperatures (95°F to 113°F, or 35°C to 45°C) and are generally used for cheeses where some degree of cooking is required. The maximum acceptable temperature for thermophillic bacteria is 140°F (60°C). Starter cultures often contain more than one species of bacteria, and some contain both mesophillic and thermophillic varieties.

SALT

This is one of the most powerful tools in the cheesemaker's arsenal. Salt does much more than enhance flavors in cheese; it can also aid in further extracting moisture from curds or wheels, curb the development of acid during cheese making, and limit the growth of pathogens or spoilage bacteria in developing cheeses.

Selecting salt for home cheese making is not difficult, but there are some important things to know. Do not use iodized salts; the iodine in these salts will kill the very bacteria that are helping you turn milk into cheese. The preferred format for cheese-making salt is thin flakes rather than bulky granules because they will dissolve easier. If you have difficulty finding flakes, you could use a kosher salt with small grains; just be sure it is noniodized. Pickling salt is a reliable option as it is always noniodized. Stay away from rock salt as it takes the longest to dissolve.

Salt composed of thin flakes will dissolve well into the curds or on the surface of cheeses.

A collection of commonly found starter and secondary cultures. Clockwise from upper left: thermophilic starter, mesophilic starter, *Brevibacterium linens*, *Penicillium roqueforti*, *Geotrichum*, *Penicillium candidum*, and *Propionibacterium shermanii*

BE AWARE OF BACTERIOPHAGE

Sometimes referred to as simply "phage," this term refers to a virus that infects starter culture cells. The result of this infection is that the starter becomes either totally ineffective or severely weakened. If the starter cultures cannot adequately raise the acidity, successful coagulation will not be possible.

There are two defenses against phage: The first is a rigorous cleaning and sanitation program that aims to prohibit this type of virus from developing within your cheese plant. Whey is a favored medium for these viruses, so it is important to thoroughly clean anything that comes into contact with whey.

Second, cheesemakers can reduce their vulnerability to phage by rotating through similar but unique strains of starter cultures on a regular basis. This rotation breaks the virus's ability to work its way through the starter's defenses.

SATURATED BRINE SOLUTION

Commercial recipes call for different levels of salinity for brining cheese, but when making cheese at home it is best to use a saturated brine solution because it is easier to create and maintain.

To create a saturated solution, add 1½ lbs of noniodized salt to 2 quarts of boiling water (or 720 g salt to 2 L of water). Pickling salt or kosher salt are both noniodized and the weights above convert to approximately 3 cups (900 g) by volume. Stir to dissolve the salt and then cool the brine to room temperature. After cooling some of the salt will precipitate out as a fine powder at the bottom of the container. This is expected and ensures that your solution is saturated.

Add ½ teaspoon of distilled white vinegar and 1½ teaspoons (7.5 ml) 30 percent calcium chloride solution to the brine. This will balance out the acidity and calcium ion levels to be close to that of the cheese to be brined.

Brine can be stored in a cool location and reused for many cheeses. Add more salt to keep it saturated if none can be seen in the container. Boil the solution and strain through cheesecloth from time to time.

Remember, cheese is less dense than brine and will float, so it is important to flip and turn cheeses regularly so that all surfaces are exposed evenly. Don't overcrowd brine with cheese—if cheeses are touching, the surfaces in contact with other cheese aren't exchanging salt with the brine.

COAGULANTS

These are enzymes used by cheesemakers to coax the liquids and solids in milk to separate so the solids can join together and form the mass we call curds. The way the enzymes do this is by denaturing the most prevalent protein in milk, casein, so that it transforms its structure from floating long chains into a connected lattice-like network. This lattice becomes the foundation of curd formation. Reformed casein is able to separate from water molecules and to catch fats and minerals in its web.

It takes a specific enzyme to transform casein (the main protein in milk) in such a way that it can release moisture and begins to connect to one another and other solids within the milk. Enzymes that serve as catalysts in coagulation can come from the following sources:

Plant: Thistle plants contain coagulating enzymes. Traditionally this type of coagulant has been used in the production of sheep's milk cheeses.

Animal: The abomasum, or fourth stomach, of young, unweaned ruminants contains an enzyme called rennet that coagulates milk. This enzyme is also sometimes referred to as traditional rennet.

Microbial: There are two types of microbial coagulants. First, there is a fungus that produces an enzyme similar to rennet when the fungus is fermented. The second microbial coagulant is made by splicing a calf gene into a yeast cell; causing it to produce an enzyme chemically identical to that in calfrennet.

The beautiful, electric purple stamens of some thistle plants can be dried, ground, and soaked in water to make a coagulant.

Rennet tablets have a longer shelf life than liquid rennet, making them great to have on hand for less frequent cheese making.

EQUIPMENT

As with any hobby, the more the interest in home cheese making grows, the more cheese-making gadgets appear on the market. The good news is that wonderful cheese can be made with the most basic equipment. Most important is that you spend adequate time and effort ensuring that the equipment you use is clean.

Clear all clutter away from your work area and clean all surfaces before wiping them down with a cloth dunked in sanitizer. Make your own sanitizer by combining 2 tablespoons (30 ml) of household bleach with 1 gallon (4 L) of water. All equipment should be washed in hot and soapy water, rinsed, and bathed in sanitizer before use. It is best to allow your equipment to air-dry if possible.

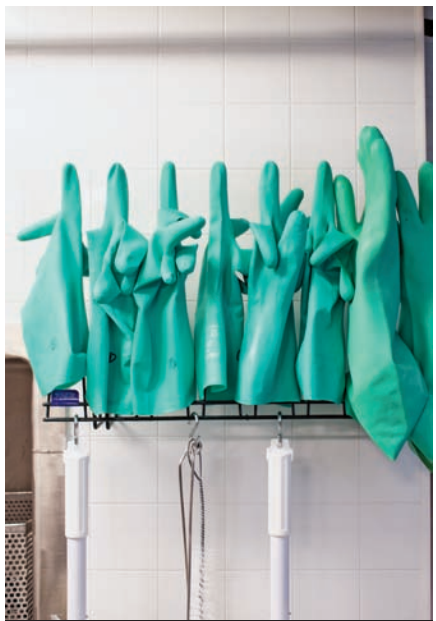
The more quickly you wash your tools following cheese making, the easier it will be to remove persistent bits of milk proteins that like to hang on. Rinse all used tools with cold water first, then wash them in hot and soapy water, rinse again in cold water, and finally sanitize before allowing them to dry completely.

VAT

In your kitchen, a vat masquerades as a stockpot. The ideal candidate for the job has a heavy bottom to help evenly distribute heat and is free of any coating such as Teflon that might have scratches that can provide safe harbor for bacteria. See "How to Maintain Temperature" on page 35 for tips on making your vat effective.

THERMOMETER

Temperature is important in every cheese recipe, so if there was ever a place to splurge on equipment, this is it. Look for a dairy thermometer or invest in a model highly lauded for its speed and accuracy, such as a Thermapen.



Thick gloves used for cleaning hang to dry at Beecher's Handmade Cheese in New York City.

SPOONS

Metal spoons are advisable because plastic and wood have a higher risk of harboring bacteria even after cleaning and sanitizing. You'll need measuring spoons as small as 1/8 teaspoon in size and a large spoon for stirring.

CHEESECLOTH

Though you can buy cheesecloth at many supermarkets, be sure to buy butter muslin cheesecloth. Any other kind will have too large of a weave, which allows valuable bits of curd to slip through. Cheesecloth can be reused so long as it is thoroughly cleaned and sanitized.

FORMS

Creativity is king when it comes to cheese forms. For fresh cheeses, where shaping can be done by hand, any vessel resembling a basket that can be lined with cheesecloth (think colander) will suffice—keeping in mind that the vessel will need to be scrubbed clean and sanitized. Some recipes call for forms with followers; these are cylindrical forms with no top or bottom that come with a lid that inserts on either end to allow for effective pressing.

CURD KNIFE

The key to a curd knife is its rounded tip that prevents it from scratching the vat. Curds are quite soft, an almost flan-like mass, and don't require a sharp edge for effective cutting. Substituting with a standard chef's knife will generally work, but be sure that it is long enough to reach the bottom of the vat.

This collection of equipment is a home cheesemaker's dream.

HOW TO MAINTAIN TEMPERATURE

Most cheese recipes have a step or two that involve maintaining, increasing, or decreasing temperature in a very controlled manner. This is a challenging task for professional cheesemakers working with equipment designed for cheese making, let alone the home cheesemaker working with modified kitchen tools. The obvious points of advice for home cheesemakers are to do your best and take copious notes so you can understand the impact of your actions.

Beyond those points, there are some tools and methods that can help. The most low-tech option is to re-create the water jacket that most commercial cheese-making vats have by nesting one stockpot inside another that is filled with water, a riff on a double boiler. This arrangement will help to prevent scalding and will distribute heat a bit more evenly throughout the milk.

Alternatively, you can invest a few hundred dollars, purchase an electronic temperature control device, and use it with a single-plate electric or induction burner. Although it doesn't stir the milk for you, the temperature control gadget plugs into the burner and holds it at the temperature you specify—a huge help during cheese making.

An electric hot plate connected to a temperature control device provides greater control of temperature for home cheesemakers.

LADLE

A large, perforated ladle is very helpful for moving curds quickly from the vat into the forms. This could also likely be accomplished rather effectively using a slotted spoon so long as the perforations were small enough that curds could not pass through.

PRESS

There are many household items that can function as a press—canned food, jugs of water, your own hands—but there are some nice models available for home cheesemakers who are making enough pressed cheeses to justify the investment.

ATOMIZER

Occassionally recipes recommend that ripening bacteria are mixed with water to make a solution that is applied directly to the surface of a cheese after it is made rather than added to the milk during cheese making. An atomizer is a small spray bottle that has adequate pressure in its little pump to create a fine mist.

WAX

Although some veteran cheesemakers admit to melting down crayons for cheese wax in the early days, home cheesemakers now have access to very affordable food-grade wax in a variety of colors.

pH METER

This is absolutely a tool for the advanced set—not a necessity for most home cheese making but helpful for those looking to better understand what is happening during the make. Many professional cheesemakers use these meters at points during cheese making when what they can see and touch doesn't give them sufficient information to make decisions. If you use a pH meter, be sure to carefully follow the instructions for use and cleaning, as they are sensitive pieces of equipment.

This elegant and simple press evens out the distribution of pressure across the cheese being pressed.

CHEESE MAT

There are plastic mats specially designed to be good surfaces for aging cheese. For the entry-level attempt, a bamboo sushi mat could pinch-hit as a mat for maturing cheeses. The nice thing about plastic mats is they won't absorb any moisture from the cheese and they are easier to thoroughly wash and sanitize.

CHEESE PAPER

Carefully crafted cheeses deserve proper handling. There are specialized cheese papers that allow for varying degrees of breathability. These can be useful in the final stages of aging and once cheeses have been cut. The main benefit of these papers is that they protect the cheese without completely shutting it off from fresh air that the cheese needs to continue to thrive.

Ivan Larcher is committed to protecting the biodiversity of microbes that make it possible to produce the wide range of flavors and textures in cheeses around the globe.

IVAN LARCHER,
CHEESE-MAKING CONSULTANT, LARCHER CONSULTING, CHÉNIERS, FRANCE

A respected technical advisor to cheesemakers of all scales, Ivan Larcher provides technical assistance and evaluations of cheeses in his native France and in countries around the world. In addition to his reputation as a skilled consultant, his increasing concerns around the loss of biodiversity in cheese cultures and his outspoken nature have earned him a spotlight in discussions about cultures, flavor, and terroir.

YOU TRAVEL THE WORLD TO WORK WITH CHEESEMAKERS. HAVE YOU NOTICED ANY GLOBAL TRENDS?

What I've been seeing is that everybody tends to use the same starters that are produced by a few major companies—like Danisco and Hansen. There are a few others, but 80 percent—more or less—of cheesemakers all over the world are using those starter cultures.

The main consequence is that the final products lose their diversity. There are various ways to look at the identity of the final product, but a lot of the aromas produced during aging come from the diversity of the bacteria, yeasts, and molds that we find, collect, or inoculate in the milk. We think raw milk makes better cheese, but it's not true if we consider the overloading of the milk with commercial or very simplified mixes of starter cultures.

WHAT'S THE BASIC FUNCTIONALITY OF A STARTER CULTURE AND WHEN DOES ITS ACTIVITY BEGIN AND ENDS?

First, we need to divide the starter cultures into two families. First are the acidifying starter cultures that have the purpose of acidification. The other family is the aging starter cultures—bacteria, yeasts, and molds.

Lactic starters produce lactic acid by metabolizing lactose, the sugar in milk, and lactic acid is a by-product of this. This lactic acid contributes to the acidification of the milk. In the first hours of cheese making, acidification permits the transformation of liquid milk into solid milk with the use of rennet. Acidification allows the demineralization of the protein micelles. This loss of calcium in the curd permits the drainage of the whey. Without acidification we don't have proper drainage. The last point—but in many countries it is considered an objective—is that very fast acidification contributes to food safety. Acidifying limits or inhibits the development of pathogens or undesirable bacteria.

MANY PEOPLE REFER TO THE ACID BUILDERS AS "STARTER" CULTURES AND AGING CULTURES AS "SECONDARY" CULTURES. IS THAT INCORRECT?

I don't like the term *secondary* because they are as important as lactic starters in terms of cheese production. They have distinct roles, but I'm not sure that one is more important than the other in terms of global cheese production.

DO YOU SEE MISUSE OF ACIDIFYING CULTURES?

I was with the traditional Somerset Cheddar producers discussing problems of the acidification profile. Over the last decade everybody is looking for a faster acidification profile to be able to mill within five hours after rennet. This has forced cheesemakers to use a faster, stronger starter culture. The consequence is that there are very few strains that are able to acidify so fast, so those are sensitive to phage attacks—we created industrial problems by looking for faster acidification.

The second problem is that those types of starters produce bitterness. In order to manage the bitterness, we've been adding bitterness-control bacteria such as *Lactobacillus helveticus*, coming from Swiss-style cheeses, making Cheddar sweeter. Traditionally Cheddar has never been sweet and mild—the main characteristics were sharp and crumbly. The industry, economics, and production costs can completely modify the identity or typicity of a product.

DOES BUILDING ACID AT THE BEGINNING OF THE CHEESE-MAKING PROCESS HAVE CONSEQUENCES THROUGHOUT MATURING?

Yes, we have a pH profile or acidification that develops at various speeds from inoculation to about forty-eight hours after starter is added. The level of acidity at the moment we separate the curds and the whey will have a direct impact on the texture.

If we acidify in the vat before molding, this demineralizes the curd, we lose calcium into the whey, and we get a crumbly texture; this is lactic-style cheese where the texture is plastery, chalky, and crumbly, because we've acidified into the whey. If we acidify after molding, when there is no whey left, we keep all the calcium in the cheese. This calcium permits the creation of links between proteins; it makes the cement in the paste so we end up with a more elastic texture found in cheeses like Gruyère and Emmental.

HOW CAN A CHEESEMAKER CONTROL OR ADJUST ACID DEVELOPMENT?

To control this we need to select the right type of starters—fast, slow, or a combination. We need to play with the temperature where we inoculate, the quantity and type of starters, and the maturation of the milk before adding the rennet. Do we give the starter twenty minutes to do the job, or do we give them five hours before adding the rennet?

When we notice, it's too late—the only way to know is to check the pH of the curd or the titratable acidity of the whey after cutting. If we notice that it's too acidic at this stage, we have two techniques. The first is to hurry up draining, stirring, cooking, and so on; the starters are running faster than we are, so we need to start running as well—not to be passed by the starters. The second technique is to wash the curds by replacing some whey with water.

DO YOU SEE A LOT OF PRODUCERS THAT DON'T UNDERSTAND WHAT'S HAPPENING IN THEIR CHEESES OR HOW TO CORRECT IT?

For many years, artisan cheesemakers have been able to produce and sell cheese without a lot of issues because the market was there and because there was not a lot of competition. Now cheesemakers starting out have to sell cheese to customers who know more about cheese and quality, so they can't afford to work empirically like they did before.

In France we have a lot of colleges and technical resources and technicians who are working for the government or for the AOC networks to provide technical support for farmstead or artisan cheesemakers. In many countries, England or the United States, for example, technical support for small units is not developed, so the cheesemakers are left alone to develop tools, techniques, or products.

DO YOU HAVE SIMILAR CONCERNS ABOUT LOSS OF DIVERSITY IN THE "AGING" STARTERS?

Yep. The main purpose of aging bacteria —yeast and molds—is the aesthetic aspect of the cheese. They bring enzymes responsible for breaking down proteins and fats in the cheese and producing aromas. When lactic bacteria are alive, they acidify; when they die, they release the intracellular enzymes. Lactic-acid bacteria plus aging stuff—they all release enzymes in the curd and each species of bacteria, yeasts, and molds has its own enzymatic toolbox.

I consider cheese making the same as a car that you bring to the mechanic's if you ask him to dismantle all the parts. If he only has one screwdriver, one hammer, and one wrench, this mechanic will be able to dismantle the wheels and the seats, but that's all, so the car will stay in big parts. Cheese is exactly the same; proteins will stay in big molecules, and big molecules have no aroma. If we want this car or this cheese to be dismantled completely, we need to have as many friends as possible coming with their own toolboxes, and maybe we will have enough diversity to be able to dismantle all the pieces of the car. The more enzymes we have, the faster the aging. The more diversity of bacteria, yeasts, and molds, the more diversity of enzymes we will get in the final product.

YOU ENCOURAGE CHEESEMAKERS TO PRODUCE THEIR OWN STARTER CULTURES. ARE THERE RISKS ASSOCIATED WITH DOING THAT?

Homemade starter is the Pandora's box and the holy grail of cheesemakers. Every cheesemaker should look for the homemade starter culture to be sure that the starters they have—acidifying and aging starters—are ones that develop in their area, on their farm. This would decrease production costs and produce a cheese with a specific identity related to the bacteriological spectrum of the farm.

Forty to seventy species of microbes are identified in raw milk, and this spectrum is usually constant on a farm. Throughout the year we keep the same families, but depending on the season and climate, the quantity of each bacteria will be different because the grass, climate, temperature, soil, and farming practices are changing. This spectrum is very specific from farm to farm—even a few miles between two farms will be enough to create a difference in bacteriological spectrum.

The problem is, we don't yet know a 100 percent efficient method to develop this spectrum, to develop homemade starter cultures. The first thing to do with homemade starter culture is analyze it, because we are going to use it to inoculate all the milk coming into the dairy, and if this initial starter is contaminated by chloroform, *Listeria*, *Salmonella*, *Staphylococcus aureus*, we are going to transmit those bacteria into the various batches. So first thing to be done is to analyze it, then when we know it's clear, we can start to use it.

DO YOU MAKE STARTER CULTURE BY HOLDING MILK FOR HOURS TO ALLOW NATURALLY OCCURRING MICROBES TO DEVELOP?

That's the easiest method. We want to develop the bacteria already in the raw milk—give them a chance to develop by putting the milk at an optimal temperature. The optimal temperature would be the curdling temperature of the cheese you plan to make.

Homemade starter is the Pandora's box and the holy grail of cheesemakers.

DOES A CHEESEMAKER NEED TO UNDERSTAND MICROBIOLOGY TO DO THIS WELL?

An artisan cheesemaker cannot be something other than a microbiologist. A cheesemaker must be the guy in the circus with a whip who is trying to control the lions and tigers; a cheesemaker is doing exactly the same thing. By using various tools, he wants some species to develop and others not to develop.

HOW MUCH FLAVOR AND TEXTURE IN A CHEESE CAN BE ATTRIBUTED TO NATURALLY OCCURING BACTERIA VERSUS THOSE ADDED BY A CHEESEMAKER?

That depends on the initial inoculation dosage. If we overload the milk with commercially produced lactic acid bacteria, this high population of bacteria will cover all the territory, eat all the food, and potentially fight the others so we end up with a dominant population of commercial starters. This dominant population will create this specific aroma that is usually milder.

If we control the dosage of starter and lactic acid bacteria with the target of having the right acidificaiton profile, we give the other bacteria a chance to develop so they can express themselves and produce aromas, colors, or flavor.

WHEN YOU ASSESS CHEESES, HOW MUCH INFORMATION DO YOU NEED ABOUT HOW IT WAS MADE TO BE EFFECTIVE IN IDENTIFYING PROBLEMS?

This is the most complicated part of my job; I regularly receive phone calls or emails saying that the cheese is not good. Most of the time the cheesemakers are not able to explain why the cheese is not good. The problem would be solved in 50 percent less time if the cheesemakers were able to describe, using the right terms, the defects that they don't like in the cheese.

Take the example of dry versus chalky. Cheesemakers call me saying they're trying to make a semihard cheese and don't like it because the texture is dry. When they detect shortness or chalkiness in the paste, they feel that the texture in the mouth is dry. The problem is that chalkiness comes from the cheese being too moist, but when they say the cheese is too dry, we tell them to stir and drain the curd less before molding. By doing so we increase the quantity of whey kept in the curd, increase the sugars kept in the cheese so the starters will continue to acidify, completely demineralize the paste, and make the cheese more chalky. Having the right terms to identify the defect would save a lot of time.

IVAN LARCHER ON THE ROLE OF ACIDITY IN AFFINAGE

If a cheese is sold after ten or fifteen days, there is not enough time for the bacteria, for the enzymes to do the job. We need specific activities to happen—like the pH of the cheese needs to be over 5 in order for the enzymes, particularly proteases, to work. If we produce a cheese and end up with a final acidity of 4.3 or 4.4—way too low for the enzyme activation—the enzymes will be in the curd but won't be active. We need deacidification; we need yeast in the raw milk or that we inoculate with to eat the lactic acid and, by eating the lactic acid, raise the pH. If the pH rises, the enzymes will start working.

That's what happens in lactic-style cheese such as Coupole made by Vermont Creamery. We have acidification then we develop *Geotrichum* on the rind. *Geotrichum* consumes the lactic acid, so just under the rind of *Geotrichum* the pH will be over 5 and the enzyme will start working in this zone. Slowly, core lactic acid migrates to the surface to rebalance lactic acid all over the cheese, and this lactic acid is eaten by the *Geotrichum*. The enzymes work from the surface going down to the core of the cheese. We call it *centrifuge aging*—it starts from the outside and goes in because of this pH evolution in the cheese. If a cheese starts at pH over 5 as in Cheddar or Gouda, we have a global activation of the enzyme in the core and on the rind because throughout the cheese the pH is over 5.

Coupole from Vermont Creamery

Cheese vat, thermometer, spoon, cheesecloth, measuring spoons and form—essential equipment for home cheese making

CHAPTER 3: MASTERING THE FUNDAMENTALS OF CHEESE MAKING

The first three steps in every cheese recipe are essentially the same. Together these techniques form the foundation of all cheese making. Recipes that include only these core techniques, possibly with the addition of some draining of the curds, are important to practice and master before moving on to more involved cheese makes.

HOW TO PASTEURIZE MILK AT HOME

Pasteurizing milk at home is not complicated. There are two options, the same as in a commercial cheese plant:

1. **Heat milk to 145°F (63°C) and hold at that temperature for 30 minutes.**
2. **Heat milk to 161°F (72°C) and hold at that temperature for 15 seconds.**

Some cheesemakers insist that the lower temperature, longer hold is less damaging to the milk overall. Whichever option you choose, it is strongly recommended that you heat the milk in a double-boiler setup that mimics a pasteurizer or cheese vat with a water jacket.

You will need two stockpots; one needs to fit inside the other. Fill the larger stockpot a third of the way to halfway full. Pour the milk into the smaller stockpot and then nest it inside the larger pot. Place the whole setup over heat and stir occasionally. If you can't create a water jacket, you can still pasteurize; you will just need to stir the milk the entire time to ensure there is no scalding, and you may face bigger challenges controlling the temperature.

Once you have hit your target temperature for the required amount of time, place the stockpot containing the milk into a cold water or ice water bath—this can be set up and waiting in your sink. Cool the milk down to the inoculation temperature for the recipe you're working with, or, if you are storing the milk, cool it all the way down to 40°F (4.5°C) before placing it in clean and sanitized containers and stowing in refrigeration.

STEP 1: RIPEN MILK

This first step is the addition of a starter culture, made up of lactic bacteria, to milk that has been warmed to the stated innoculation temperature for the recipe **(A–C)**. Milk has naturally occurring *lactic bacteria* that survive by metabolizing lactose, the sugars in milk, into lactic acid. The goal of this first step in cheese making is to increase the acidity of the milk to prepare for the next step, coagulation.

Adding starter culture made up of lactic bacteria works as a booster for the existing population of lactic bacteria and accelerates the development of acid. The milk will need to be heated slightly, unless it is coming straight from the animal, giving it natural warmth, to create an optimal environment for starter cultures to rapidly grow and reproduce.

a Heat milk over medium-high heat to the initial innoculation temperature of the recipe. Stir occasionally to avoid burning.

b Measure starter culture by tapping out of packet into appropriately sized measuring spoon.

c Sprinkle starter culture into milk when the temperature hits the target temperature. Stir gently but thoroughly.

STEP 2: CULTURE

Here the cheesemaker is adding specific cultures **(A and B)**. These are bacteria, molds, and yeasts or combinations of the three that will affect everything from flavor development to the texture of the paste or the type of rind that grows. These can be added either before or immediately following the coagulant, before the milk begins to "set."

a Measure secondary culture by pouring it into a measuring spoon.

b Add secondary culture to ripened milk and stir gently but thoroughly.

STEP 3: COAGULATE

Milk is made up of water, fats, proteins, and minerals. Coagulate means to transform something from a liquid to a semisolid or solid state. This is exactly what happens in cheese making—a separation of the solids (fats, protein, and minerals) from the liquid portion (water) in milk.

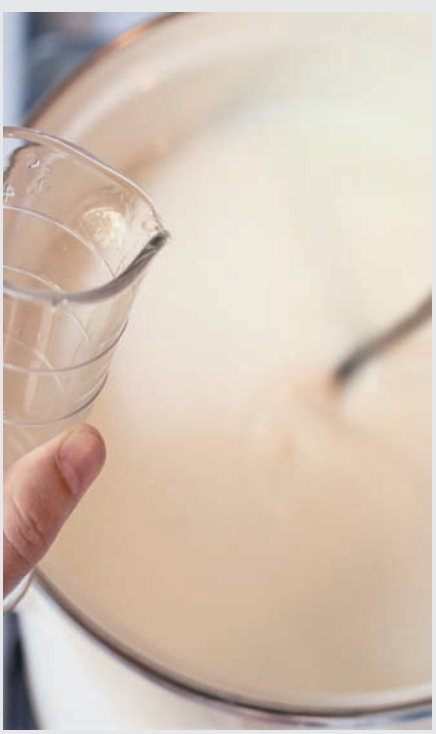
In this step, a coagulant is diluted in water **(A)** and added to the milk to begin the process of pulling solids away from the water in milk and encouraging them to knit together, forming curds **(B)**. The volume and concentration of coagulant added to the milk, and the temperature and acidity of the milk all affect the effectiveness of the coagulation. Confirming appropriate temperature and acidity prior to adding the coagulant is important for a successful coagulation.

All coagulants, including liquid rennet, need to be combined with water to help distribute them more evenly throughout the milk. Coagulants should be diluted in a measure of water that is twenty times their volume; often recipes will do this calculation for you. Rather than stirring only in a sideways circular motion, you want to stir in a circular motion that goes from top to bottom. Do not stir vigorously; instead focus on being thorough, and when you're finished hold the spoon so that the head is sideways in the milk—helping to still the liquid before gently lifting the spoon out.

The goal is for a delicate mass of curds to form. Completion of coagulation is evaluated by testing the curd to see if there is a clean break when either a curd knife or finger is inserted and drawn gently up toward the surface **(C)**.

Note: There is something called lactic coagulation in which very little coagulant is added to the milk. Lactic bacteria do most of the work on their own over a long period of time—think hours instead of minutes—to separate the solids from the liquid within the milk. This yields a more delicate curd.

a Dilute coagulant in nonchlorinated water.



b Add diluted coagulant while stirring.

c Insert finger at a 45-degree angle beneath surface of curd, and press up gently until curd splits in two.

ADDITIONAL TECHNIQUES

Beyond the core steps are the additional techniques that help cheesemakers achieve various textures and flavors. Each cheese recipe has a unique combination of techniques, and this is what makes it possible to create thousands of varieties of cheese using the same basic ingredients. Recipes included in this book employ combinations of the techniques that are used to produce some of the world's most well-known and appreciated cheeses.

CUT

The mass of curd is cut using a knife or a cheese harp to the size specified in an individual recipe. This step is technically optional because not all curd is cut before being drained or ladled into bags or forms. After cutting, curds are allowed to heal briefly before proceeding to the next step.

WASH

A portion of the whey is drained from the vat and replaced with water. This step lowers the acidity of the curds and results in cheeses that are more pliable and tend to be a bit sweeter.

COOK

The curds and whey are brought up to a high temperature and stirred, to prevent them from attaching to one another, for a period of time. This helps extract more moisture from the curds.

DRAIN/HOOP

Hooping is the process of scooping, pumping, or pouring curds out of the vat either into cheesecloth or some kind of form where whey can continue to drain.

CHEDDAR

Whey is drained from the vat and curds are allowed to clump together, forming large mats. The mats are cut by hand with knives into even strips that get stacked on top of one another. Strips are flipped and restacked repeatedly, allowing them to act as presses for one another and also giving time for the acidity within the curd to continue to rise. Once target acidity is achieved, the strips are run through a mill to make finger-sized curds and then salted before being placed in hoops.

PRESS

This can take a few hours or a few days and can be done using the weight of wheels of cheese within the freshly made batch or a pneumatic press. The amount of pressure applied and length of time determines the resulting texture and moisture content of the cheese.

SALTING

There are a number of ways cheesemakers can add salt to cheese. The earliest would be after the curds are cut and the whey has been drained. Fresh cheeses often have salt mixed into them after they've had a chance to drain. Cheeses can be soaked in brine or rubbed on the outside with salt after they come out of their forms.

AFFINAGE

For many cheeses this is the longest "step" in the cheese-making process. Affinage refers to the aging or curing of a cheese. This largely takes place in cool, damp environments where temperature, humidity, and airflow are monitored closely. Common affinage activities include turning cheeses, brushing and/or washing their exteriors, and trying to provide exactly the correct environment to foster growth of desired microbes. During this stage, cheesemakers are coaxing the development of rinds and the well-paced breakdown of fats and proteins in hope of achieving a specific texture and flavor profile.

AGING CHEESE AT HOME

The home cheesemaker should not shy away from cheeses that require longer aging. There are relatively simple and thrifty ways to create a temperature- and humidity-controlled environment. A small piece of equipment, an external refrigerator thermostat, that can be plugged into a refrigeration unit—think dorm room or wine fridge—will allow you to override the programmed temperature range of the refrigerator. This allows you to make it warmer, the target range being anywhere from 45°F to 58°F (7°C to 14.5°C) depending on the cheese you're aging.

Ideally the aging fridge would maintain 80 to 98 percent humidity. To create humidity within the unit, you can leave an open container of water or a damp cloth on the bottom shelf. Be sure to keep these items clean and do not allow them to touch the cheeses. Keeping the unit as full of cheese as possible (remembering that you want to avoid cross-pollination of molds of different types of cheeses) will also help maintain humidity.

If there is still too much airflow and cheeses are drying out, place cheeses on bamboo or plastic mats inside of plastic containers and place the lid atop the container without fully closing it.

Co-owner and cheesemaker Cary Bryant checks the consistency of the curd during a make at Rogue Creamery in Oregon.

CARY BRYANT,
CO-OWNER AND CHEESEMAKER, ROGUE CREAMERY, CENTRAL POINT, OREGON, USA

Armed with degrees in microbiology and biochemistry, Cary Bryant pursued academic and corporate science opportunities, rapidly becoming disillusioned with the process and politics of both. Taking a break from science altogether, he created the Dress Me Up David magnets that adorned every college refrigerator in the 1990s. At long last his creativity and scientific passions merged at Rogue Creamery, which he and his partner, David Gremmels, have revived to its former glory, producing a line of incredible blue cheeses including their best known creation, two-time American Cheese Society Best in Show winner Rogue River Blue.

IN TAKING OWNERSHIP OF ROGUE CREAMERY, DID YOU UNDERSTAND HOW MUCH SCIENCE WAS INVOLVED IN CHEESE MAKING?

I was thrilled by the amount of science that was potentially usable. When I realized [science] wasn't about curing diseases, it seemed nonapplicable, and then after making the David magnets where everything ends up in the landfill, I started feeling really dirty. When I had the opportunity to make food, create sustenance, *and* satisfy my need for science and art and productivity, it just seemed like the perfect fit for me.

UNDERSTANDING MICROBIOLOGY AND THAT CHEESE IS A LIVING FOOD, DID YOU HAVE ANY HESITATION ABOUT BEING A COMMERCIAL FOOD PRODUCER?

I was driven to create something sustainable and consumable. I wanted to move into food, so that outweighed the danger of it for me.

IS MAKING CHEESE ANY DIFFERENT THAN MAKING DINNER FOR SIX PEOPLE COMING OVER?

Oh my god, yes! When you're making cheese, you are facilitating the growth of bacteria in order to help you make it. If you are doing an acidified curd cheese like paneer where you are making it, and eating it, and it has little time for things to go bad, I think you can just follow the recipe, with the caveat that cleanliness is essential even for those cheeses. When organisms multiply logarithmically it's fast. You go from one to two to four to eight to sixteen, thirty-two, sixty-four to one twenty-eight—it just goes on and that can happen every twenty minutes, so if you start with some contamination it can get out of hand lickety-split. You want to make sure that you're very clean.

DOES THE HIGH ACIDITY OF ACID-SET CHEESES MAKE THEM SAFER?

Yes, but it's more the speed of making it and consumption, though the acid is a factor. The thing about cheese making is that you're balancing several variables to ensure the safety of the product, and it's not one variable that makes it safe—although if you push any one variable to the extreme it's likely to make it safe.

For example, if you have an extremely dry cheese it's likely to be safe but not perfectly, if you have an extremely salty cheese it's likely to be safe but not perfectly, and extreme acid is going to do it too—time is another factor. Those are the main things that ensure the safety; it's a balancing game.

It's kind of like in cooking—you cook to a certain temperature and that helps ensure the safety. But now we have this trend of cooking *sous vide*. It can make absolutely delicious food, but it's right on the edge of safe. So if you're a beginner cook, do you really want to be experimenting with the most delicious and dangerous food possible? *Sous vide* food will look and taste delicious even as it kills you if it's not done right. If it's done right, it's right at that edge.

WHAT'S THE DIFFERENCE BETWEEN CLEANING AND SANITIZING?

Cleaning is making sure you get rid of all residue that's left on a surface or product—food, protein, fat, or anything. You have to make sure all of that is off before you try to sanitize. Let's say you've cleaned and you don't have a speck of grease or residual stuff. What happens is that little bacteria get on the thing you just cleaned through the air or dust, or there might be some that are persistent enough to have made it through the cleaning cycle. Sanitizing kills all of the stuff that was living on it. You're creating an inhospitable surface or solution for life—that life being bacteria, yeasts and molds, or viruses; you're sanitizing to get rid of that.

The reason you do that in cheese making is that that life—if it's the wrong kind—can spoil your cheese. Whether that spoiling is just making it taste bad or making it toxic, who knows, but you want to make sure that you kill all of those things. You can't effectively sanitize without first effectively cleaning because almost all sanitizers will become inactivated by residue that gets left on. If you leave too much protein stuck on your equipment and then go to sanitize, the sanitizer will become deactivated and not be able to kill the organism.

Cheese molds are available in a wide range of shapes and sizes.

There are sanitizers that don't become deactivated, but they are not the ones you use in cheese making. In cheese making you don't want residual sanitizer in your milk because then your bacteria won't grow, so using chlorine to sanitize is good, but you have to make sure you clean before you sanitize.

HAVE YOU FOUND THAT THERE ARE SOME REALLY CLASSIC TROUBLE SPOTS WHEN CLEANING AND SANITIZING?

Clean your hoops and forms as soon as you're done with them so that you're getting all that stuff off as quickly as possible so it doesn't harden on. If I were doing it at home, I would start with high-quality dish soap because that seems to be able to clean everything.

SALT HAS ANTIMICROBIAL PROPERTIES. DOES THAT PROVIDE SOME DEGREE OF PROTECTION?

As a home cheesemaker, I would not try to make a low-salt aged cheese. Fine if you're doing a fresh mozzarella, but if you're going to age it, that's a dangerous thing best left to somebody else. The big risk is botulism. Salt is a good one to deal with botulism.

FOR SOMEONE JUST STARTING OUT, WOULD YOU RECOMMEND THAT THEY START WITH RAW OR PASTEURIZED MILK?

Definitely pasteurized. No doubt about it. I would start that way. As you get better, know that raw milk is always going to be a risk. It's okay to take risk in life—I don't believe it's okay to take risk in other people's lives too much. Do you serve your family raw oysters and, if so, are you all right with the level of risk? I am not saying don't use raw milk at home, just that when you do, it is risky. It is more reasonable to be exposed to microorganisms than not because you have ten times as many nonhuman cells in your body as human cells. You can imagine that most are either friendly or neutral—only a few bad ones. But, the bad ones are very, very bad.

ANY OTHER THINGS FOR HOME CHEESEMAKERS TO BE CONCERNED ABOUT?

Condensation. If you're aging Cheddar in your cooler, you don't want to get it wet and then continue aging it where it gets a drip. It's not that you're contaminating the cheese with dirty water, it's that you're suddenly creating this wet area on your cheese. You've done all this work to get rid of moisture by adding salt, etc., and you create this one little happy spot for things to grow. If your cheese had been contaminated a little but it was dry and healthy so nothing would grow that was bad, who cares if there was a little *E. coli* there—it wasn't going to grow anyway, it was almost dead. You put that little drop of water there and those things that are almost dead think, "This isn't so bad. I can come back to life, grow, and raise a family."

WHAT DO YOU DO IF YOU GET A DRIP?

Cut that area out—that moisture is not going to spread that fast—but try not to let there be drips. It's not like you're making a cheese that's going to kill you; you're just making a riskier cheese. Minimizing where drips happen is just a good practice.

You put that little drop of water there and those things that are almost dead think, "This isn't so bad. I can come back to life, grow, and raise a family."

Creamy blue cheese curds in a heart-shaped mold. When you have too many curds to fit into one mold, experiment with less traditional shapes.

Fresh cheeses can have a variety of textures as seen here with bowls of (clockwise from top) chèvre, fromage blanc, and mascarpone.

CHAPTER 4: FRESH CHEESE

The fresh cheese category includes cheeses such as chèvre, fromage blanc, cream cheese, paneer, and queso fresco. All of these cheeses have prominent sweet lactic flavors, often coupled with or balanced by bright acidity. Although fresh cheese can be quite simple, it can still provide great satisfaction consumed on its own or used in cooking. These cheeses can be produced in just a few steps, but the steps involved are the foundation for all other cheese recipes, so it is wise to hone your skills with fresh cheeses before advancing to more complex techniques.

One thing to keep in mind when making fresh cheeses in particular is that they will be a direct expression of the milk you are using. This simplicity of these cheeses is both the beauty and the challenge as there is nothing to hide behind—unless of course you add herbs and seasonings. Every flavor in the milk will be on display, so it is a very good idea to start with the highest quality milk you can find.

CONSISTENCY IN MILK

Home cheesemakers may encounter variation in milk, especially if it is purchased directly from a small farm that is unlikely to be manipulating the milk to adjust for seasonal differences. As animals go through their lactation cycle, the makeup of their milk changes; this is a natural adjustment their bodies make to address the changing nutritional needs of their young.

Generally speaking, dairy farmers can do a number of things to limit variation in the milk their herds produce. The two primary ways for the farmer to maintain consistency in the milk are to feed the animals the exact same diet every day and to stagger breeding of the animals so that differences occurring naturally due to their lactation cycles are sort of averaged out. If a farmer's primary goal is consistency of milk day to day, fresh pasture cannot make up a large portion of the herd's feed because pasture changes with the weather and seasons.

Even if farmers control feed and breeding, they are still vulnerable to seasonal changes; for example, animals drink a lot more water when it is hot, and that alters the makeup of the milk they produce. Even under controlled conditions, milk will have some variation, and cheesemakers must decide how to respond to this. Will they take steps to standardize the milk, modify their recipe on a daily basis to accommodate fluctuations in the milk, or make different cheeses depending on the season and its influence on the milk?

Paula Lambert in the small retail store attached to her cheese factory in Dallas, Texas

PAULA LAMBERT,
FOUNDER AND CHEESEMAKER, MOZZARELLA COMPANY, DALLAS, TEXAS, USA

In the early 1980s the idea of American cheese did not include luscious rounds of mozzarella. Paula Lambert changed that with her admirable determination and her passion for Italian food. Blazing a trail for cheesemakers around the country, she has continued to share her expertise in cheese making through classes at the creamery, across the globe, and in her two cookbooks that cover all aspects of cooking with and enjoying cheese.

YOU HAVE TAUGHT SO MANY PEOPLE TO MAKE MOZZARELLA AT THE FACTORY. WHAT ARE SOME OF THE KEY TEACHINGS?

A lot of people who try to make mozzarella think they don't have to worry about the pH. People think that you pour cultures in, wait a certain amount of time, and it's going to be the same every time. What I cannot emphasize enough on making the mozzarella, it has to be the right pH, and if it's not it won't stretch. That is something that people have got to know; they have got to have some pH strips or a pH machine, and once you tell them that then it works out. It's not a secret, but people don't comprehend it.

DID THE PEOPLE YOU LEARNED FROM IN ITALY USE A pH METER?

Yes, everybody uses a pH meter. How can you make mozzarella without one?

IS MOZZARELLA THE BEST CHEESE FOR SOMEONE TO START WITH?

No, even if they buy the curd. I think it's hard because the texture is so important.

IS THERE A GOOD CHEESE FOR PEOPLE TO START WITH?

Yes—cream cheese or goat cheese. I think those are really easy and you can just barely make a mistake on those cheeses.

YOU MAKE CHEESE FROM RAW AND PASTEURIZED MILK. DOES PASTEURIZING MILK PRESENT ANY CHALLENGES FOR CHEESE MAKING?

No, it's really good first off because you know there are no harmful bacteria in the milk. Second, you start out at the same point every time because you've killed a certain number of bacteria and then you're going to inoculate it with culture that is a good bacteria. You don't have any crazy stuff in there, wild bacteria that would throw things off.

Mozzarella has to be the right pH, and if it's not it won't stretch.

ANY RECOMMENDATIONS FOR PEOPLE WHO BUY RAW MILK AND THEN PASTEURIZE AT HOME?

I think that the hardest part about making cheese at home is that you're working with such small quantities of milk and because you have a small amount of milk, it's hard to keep it at the right temperature. And beyond pasteurization, every cheese recipe requires that the cultures be added at a certain temperature, and that the temperature be maintained while you're maturing the cheese (not aging but maturing it while you're making it.) And it's hard to keep the milk at that right temperature.

You can't keep a gallon of milk at a constant temperature—you have to put it in a water bath or in a water bath and then the oven and then try to keep the oven at a stable temperature—it's very hard to do with a small amount of milk. And people will tell you to keep something at room temperature, but room temperature isn't specific and it varies depending on where you live.

IS THERE ANY ONE THING THAT IS THE MOST CHALLENGING ASPECT OF MAKING FRESH CHEESE?

No, but I do think it's important to sterilize everything and have a chlorine bath that you dip your utensils, your cheesecloth, and everything like that into.

YOU MAKE FRESH CHEESES AND AGED CHEESES. DO YOU LOOK FOR DIFFERENT QUALITIES IN THE MILK THAT YOU USE FOR EACH OF THOSE?

No, we just use what we get from the dairy. We don't separate out the fat, and we don't standardize. There are certain kinds of milk that are good for certain kinds of cheese—but for someone starting to make a certain cheese, I think they just need a good, clean milk.

CAN YOU TAKE A RECIPE AND USE EITHER COW'S OR GOAT'S MILK?

Pretty much, and you can also mix the milks. You really don't have to adjust. It depends more on the fats and the solids and the proteins than on the type of milk. There could be minute adjustments, but it's not really that different. But with sheep's milk, you would want to put less rennet in because it's so high in solids it would overcoagulate.

DO YOU HAVE ANY ADVICE FOR HOME CHEESEMAKERS?

Home cheesemakers have to keep really careful notes of what they do; every time they make a cheese they need to notate that they kept it at these temperatures and what they changed about it. If they have a cheese that doesn't turn out, they shouldn't try to change five things about the recipe at one time. Change one thing to see what that changes, then change another thing and see if that fixes the problem, then wait and see. That's what is so hard about doing an aged cheese—you have to wait two or three months before you see how it's going to turn out. And then you make those infinitesimal adjustments: You might add more culture or you might change the amount of rennet, you might cut the curd sooner or all these things, so you need to keep records of exactly what you're doing.

HOW DID YOU LEARN ALL THIS TECHNICAL INFORMATION WHEN YOU STARTED THIRTY YEARS AGO?

You just learn little by little. That's just the way you make cheese. When I first started out I would look in a book and try to figure out how to do it and then write down a recipe.

IF A HOME CHEESEMAKER WANTS TO ADD HERBS OR SEASONINGS TO A RECIPE, CAN HE OR SHE JUST BUY THEM AT A GROCERY STORE? IS THERE A RISK THEY WILL FERMENT?

We use all organic stuff and we use mostly fresh herbs and we use chiles. You can buy them anywhere. You'd want to wash the herbs and make sure they are clean.

Cheeses that expand beyond their expected shape like this indicate there have been technical problems—such as poor sanitation, slow starter cultures, or excessive pressing—during cheese making.

Something could ferment inside the cheese because of bacteria [called] coliforms. If you ever see a cheese that has these little gas bubbles in it that are not supposed to be there, that is probably coliform bacteria. And that could be in the milk; it's not *E. coli*, it's coliform.

IS THAT HARMFUL BACTERIA?

It could create off-flavors and change the texture of your cheese. I can remember when we first started we had cheeses that would just blow up like balloons and have big cracks in the middle.

YOU HAD A CRISIS EARLY ON IN HAVING TO DEAL WITH A PHAGE. IS THAT SOMETHING A HOME CHEESEMAKER COULD ENCOUNTER?

The home cheesemaker is not going to have to deal with the phage. You have to be using the same cultures day after day after day. It's like a virus that lives in the air and it makes your culture not work.

AND YOU'D HAVE TO BE MAKING CHEESE ALL THE TIME TO GET IT?

Yes.

Equipment

- 2-quart (2 L) saucepan
- Dairy thermometer or instant-read thermometer that reads accurately in the 70°F to 100°F (21°C to 38°C) range
- 2-quart (2 L) glass or porcelain mixing bowl
- Butter muslin cheesecloth
- Colander or large sieve and a larger mixing bowl for draining

Ingredients

- 1 pint (500 ml) whipping cream
- 1 pint (500 ml) whole milk
- 1/8 teaspoon dried mesophilic culture
- 2 drops of liquid rennet or 1/4 of a dry rennet tablet
- Bottled water
- 1/4 to 1/2 teaspoon of pickling salt

CREAM CHEESE
(BASIC FRESH SOFT CHEESE RECIPE)

Making cream cheese is incredibly easy and its flavor is so much better than the tin-foil-wrapped supermarket version. It is a fantastic starting point for your adventure of transforming liquid milk into a solid. Futhermore, the same technique is used for nearly all fresh cheeses. Once you have mastered cream cheese, try the recipes for fresh chèvre, fromage blanc, and mascarpone that follow, which are simple modifications of this basic recipe.

You can flavor any of these fresh cheeses after they are complete by adding fresh minced herbs, spices, finely chopped nuts, honey, or maple syrup (the real stuff, please—not maple-flavored syrup). Add about a teaspoon (or more to taste) of these after mixing in the salt in step 7, then stir to combine.

PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Combine the cream and the milk in a saucepan. Attach the thermometer and heat the milk mixture over low heat, stirring constantly, until it reaches 72°F (22°C) **(A)**. Transfer the milk mixture to the mixing bowl.

Alternatively, combine the cold milk and cream in the mixing bowl and heat in a microwave for 1 minute. Stir the milk and check its temperature. If the temperature is less than 72°F (22°C), return it to microwave, heat another 20 seconds, then stir and check again, repeating as necessary. Take note of the total microwave time used to heat the milk for the next time you make this recipe.

3 Add the mesophilic culture to the milk and stir.

4 Dilute 2 drops liquid rennet in 1 tablespoon (15 ml) of bottled water, or crush ¼ of a dry rennet tablet with the back of a spoon and then dissolve it completely in 2 tablespoons (28 ml) of bottled water. Add rennet to milk-and-cream mixture and stir well with a spoon for 1 minute.

5 Cover the bowl with plastic wrap and place it in a warm (about 70°F, or 21°C) location for 12 to 16 hours. Do not disturb the cheese while it is ripening and coagulating or it will not set. The mixture will resemble thick yogurt when it is done **(B)**.

6 Empty the bowl into a cheesecloth-lined colander or sieve **(C)**. Tie the corners of the cheesecloth together and suspend it over a sink or a large container **(D)**. Allow to drain at room temperature for 4 to 6 hours or until the cheese is thick enough that it holds its shape when spread with a knife **(E and F)**. Do not let draining whey accumulate and rise to the level of the cheesecloth or the cheese will not drain properly.

7 Discard the whey and transfer the cheese to a clean bowl. Using a clean spoon, mix in ¼ teaspoon (0.5 g) of salt into the cheese until it is evenly distributed **(G)**. Wait 5 minutes to allow it to incorporate and then taste the cheese to see if the salt level is to your liking. Add additional salt if necessary.

8 Store the cheese in a sealed container in the refrigerator for up to 2 weeks. The flavor will continue to improve over the first few days.

(Continued)

a **Heat the milk to 72°F (22°C).**

b **After coagulation is complete, the milk will be thick like yogurt.**

c Pour the curd into the center of the cheesecloth.

d Twist corners of cheesecloth, tying opposite corners together to form a pouch.

e Hang pouch of curds over bowl or sink to drain at room temperature.

f Unwrap from cheesecloth.

g Sprinkle salt onto cream cheese and stir.

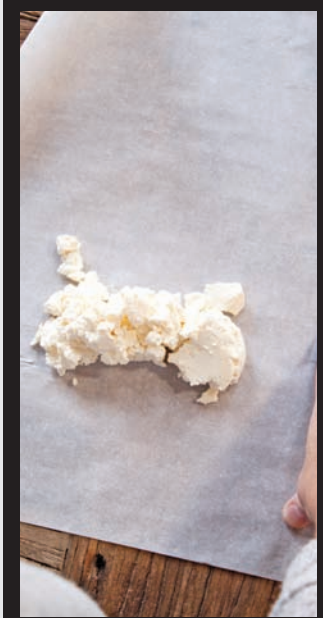
FRESH CHÈVRE

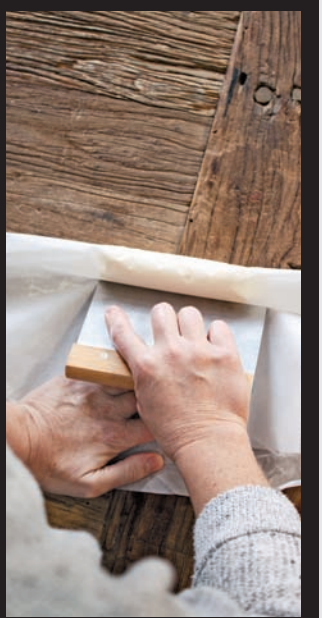
Follow the Basic Fresh Soft Cheese recipe starting with 1 quart (1 L) of goat's milk in place of the milk and cream. In step 6 drain the cheese for 8 to 10 hours or until the cheese is dry enough that it crumbles when the cheesecloth is manipulated.

Chèvre can be made nice and thick by draining for a longer period of time.

SHAPING THE CHÈVRE

One good trick for shaping the chèvre is to wrap it in parchment paper and use a straight edge such as a pastry scraper to form the cheese into a log.





FROMAGE BLANC

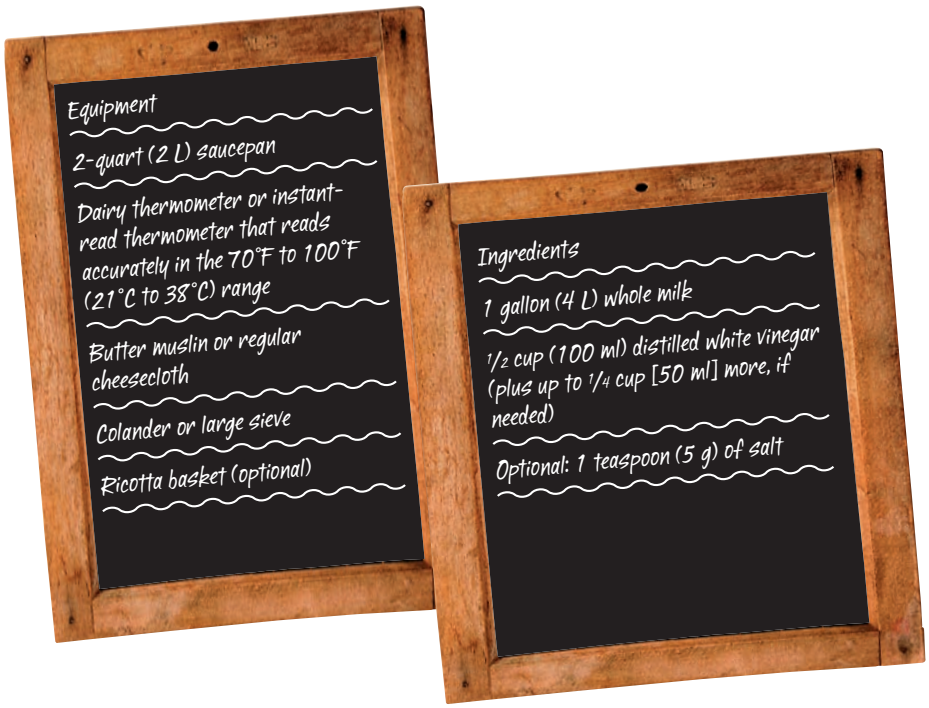
Follow the Basic Fresh Soft Cheese recipe starting with 2 quarts (2 L) of whole milk in place of the milk and cream. In step 6 drain the cheese for 4 to 6 hours or until the cheese maintains its shape when spread with a knife.

Fromage blanc makes a delicious breakfast with fresh berries.

MASCARPONE

Follow the Basic Fresh Soft Cheese recipe starting with 1 quart (1 L) of cream in place of the milk and cream. In step 6 drain the cheese for 2 hours or until the cheese is no longer watery and resembles stirred sour cream.

Mascarpone is a wonderful tool in the kitchen for adding richness to both savory and sweet dishes.



WHOLE-MILK RICOTTA

One of the simplest ways to turn milk into cheese is to heat the milk to just under boiling temperatures and then acidifying it with something like lemon juice or vinegar. No hard-to-find ingredients or equipment are required. Upon acidifiaiton, the milk separates into billowing clouds of curds and liquid whey. Just be careful to heat gently and keep stirring so that the milk does not scorch on the bottom of the pan.

Italian cheesemakers will use this process on whey produced when making hard cheese to create ricotta (which means "recooked"). In this recipe we use whole milk rather than whey, so we call it Whole Milk Ricotta. To make true whey ricotta, which is much more delicate, use this same procedure on the whey saved from making any of the other recipes in this book. Whey ricotta is delicious when eaten fresh, simply drizzled with honey and perhaps a little bit of salt. Since the whey is probably already acidic from cheese making, start with ½ cup (100 ml) of vinegar for 1½ to 2 gallons (6 to 8 L) of whey, then add more if vinegar if curds do not form.

PROCEDURE

1 Heat the milk to 190°F (88°C) slowly over medium-high heat. Stir slowly to prevent scorching **(A)**. When 190°F (88°C) is reached, turn off the heat; don't let the milk boil.

2 Stir the milk and slowly add the vinegar **(B)**. Stop stirring and let the curds form for 15 minutes.

3 You should see the milk separate into curds and translucent whey. The curds will look like boiled egg whites, as found in egg flower soup **(C)**. If no curds form, add up to ¼ cup (50 ml) of additional vinegar and stir once to combine.

4 Pour curds and whey into a colander or a kitchen sieve lined with cheesecloth. If using regular cheesecloth, fold a large sheet into quarters so four layers of cloth line the colander or sieve.

5 Allow curds to drain and cool for about 20 minutes.

6 Dip the clean cheesecloth and colander in the hot liquid for 30 seconds to sanitize them. Line the colander with the cheesecloth and pour curds and whey into the lined colander. If using regular cheesecloth, fold a large sheet into quarters so four layers of cloth line the colander or sieve. Alternatively, you can pour the curds directly into a ricotta basket, which does not need to be lined with cheesecloth **(D)**.

7 Optional: Break apart the curds and add up to 1 teaspoon (5 g) of salt, to taste.

Use right away or store in refrigerator for up to a week.

a Stir milk continually until it reaches 190°F (88°C).

b Add vinegar and stir to evenly distribute.

c Delicate curds should form; add more vinegar if needed.

d Drain and allow time to cool before serving, salting, or storing.

QUESO BLANCO/ PANEER

If you press the curds created in the previous recipe, the loose curds will form into a solid cheese known as queso blanco in Latin cultures, or as paneer in India (paneer traditionally uses lemon juice to acidify the milk, but the result is the same).

PROCEDURE

1–7 Follow steps in the Whole-Milk Ricotta recipe. Drain for 4 hours in step 6. Add the salt in step 7.

8 Rewrap the cheese in the cheesecloth, folding the cloth over the cheese loosely (don't tie corners in a knot or the cheese will have a dent in the middle). Place the wrapped cheese on a clean cutting board or a baking sheet with a lip, then place a second cutting board or baking sheet on top. Place a weight of approximately 5 pounds (2.5 kg) on top. A milk jug filled with 2 quarts (2 L) of water works well as a weight as does a few cans of food **(A)**.

9 Let this press overnight. In the morning unwrap the cheese and refrigerate. Use within 2 weeks.

Cubed paneer has a texture similar to tofu making it a great addition to a variety of savory dishes.

a Place wrapped curd on a rimmed baking sheet, cover with cutting board, and put weights on top.

Queso fresco can be crumbled over everything from chicken enchiladas to a simple salad.

Equipment

- 2-quart (2 L) saucepan
- Dairy thermometer or instant-read thermometer that reads accurately in the 70°F to 100°F (21°C to 38°C)
- Large mixing bowl
- Fine mesh cheesecloth or several layers of standard mesh cheesecloth
- Colander or sieve

QUESO FRESCO

This simple cheese introduces coagulating milk using rennet, followed by cutting and cooking the curd. It uses fairly easy-to-find ingredients making it very accessible to the beginning home cheesemaker. The amount of buttermilk used ensures a healthy dose of starter culture that is likely to overpower any undesirable bacteria that might be accidentally introduced, ensuring a safer cheese. If your batch fails to set, you may need to change brands of buttermilk as some brands don't have active cultures.

This recipe can be doubled or tripled. A single dry rennet tablet will coagulate a triple recipe. You can use 1/8 teaspoon (0.6 ml) of liquid rennet instead of the dry rennet tablet, but increase this amount proportionally if you increase the size of the recipe.

Ingredients

- 2 cups (500 ml) buttermilk (with active cultures)
- 1 quart (1 L) whole milk (not ultra pasteurized)
- 1 dry rennet tablet (look for the Junket brand)
- 1/2 cup (100 ml) water
- 1/4 teaspoon (1.5 g) pickling salt

PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Combine the buttermilk and the milk in the saucepan and gently heat to 90°F (32°C).

3 Dip a clean finger in the milk mixture and transfer a single drop of milk to the ½ cup (150 ml) of water. This will neutralize any chlorine in the water **(A)**.

Drop the rennet tablet in the water and crush it with the back of a spoon. Once it is completely dissolved, add the liquid to the milk and stir for 1 to 2 minutes. Allow the milk to coagulate for 15 to 30 minutes until firm and a clean break is achieved **(B)**.

4 Cut the curds with a knife into ½" (1.3 cm) cubes. Let the curds rest for 5 minutes **(C)**.

5 Stir the curds once, then gently heat them to 115°F (46°C) without stirring.

6 Pour the curds through a colander lined with cheesecloth **(D)**.

Once all whey has drained, gather the cheesecloth and twist it so the cheese is formed into a ball. Squeeze the curds with moderate pressure **(E)**.

Open the cheesecloth and check the cheese. The cheese should crack slightly as the cheesecloth is manipulated. If it does not, wrap it up again and twist a little longer with slightly more pressure.

7 Open up the cheesecloth and place the cheese in a clean bowl. Mix in the salt with a fork or a spoon, making sure the salt is evenly distributed.

8 Press the cheese into a ball with your hands, or shape it however you please. You can use a small cheese mold or small empty plastic yogurt container to shape the cheese into an attractive disk.

a Add a drop of milk to tap water to neutralize any chlorine.

c Allow cut curds to rest prior to stirring.

b Check for a clean break.

d Place lined collander in sink or larger bowl to catch whey during drainage.

e Firmly grasp gathered edges of the cloth with one hand and twist the ball of cheese with the other.

Wheels of a Tomme-style cheese called certoux dot the shelves of the aging room at Goldin Artisan Farmstead Creamery in Oregon.

CHAPTER 5:
TOMME AND TOMA CHEESE

One of the most common questions in the world of cheese is, "What does *Tomme* or *Toma* mean?" Both terms have been part of the cheese vernacular for centuries and have debatable etymological roots. In terms of recipes carrying these names, they most often yield cheeses that are semifirm in texture and have an abundance of lactic, milky flavors. The production of these cheeses generally involves little manipulation of the curds; they are not cooked and are only lightly pressed if at all.

Tomme is a French word used to describe a style of cheese, normally produced in the French Alps, often made with low-fat milk, and round in shape. Most Tommes have a natural rind mottled with brown, gray, and dusty white mold. This term has also been used to describe wheels of cheese whose sides are shorter than their diameter, so keep in mind that it's a somewhat malleable term at the cheese shop.

Toma has a similarly hazy definition. The term is Italian and the cheeses bearing that name tend to be made with cow's milk and come from the Piedmont region. Both Tomme and Toma cheeses usually include a reference to their town of origin, such as Tomme de Savoie or Toma del Maccagno. Some of these region-specific cheeses are name protected but most are not.

Tomme and Toma recipes are wonderful for beginning home cheesemakers because, like fresh cheeses, they can generally be made with tools you have on hand in your kitchen—except for butter muslin cheesecloth and a cheese form!

Liam Callahan holds a couple of the lambs that will provide milk for the award-winning cheeses he makes at Bellwether Farms in California.

Most of the major flaws that are going to make a cheese not good are related to moisture content—that's the thing that's driving the chemistry.

LIAM CALLAHAN,
CO-OWNER AND CHEESEMAKER, BELLWETHER FARMS, PETALUMA, CALIFORNIA, USA

One can only imagine what the neighbors said when they saw Liam Callahan chasing sheep around his parents' acreage with a salmon net in the late 1980s. Newcomers to a dying industry, Liam and his mother, Cindy, built a viable family business around their flock of sheep and milk from a neighbor's Jersey cows using old-world recipes and new-world persistence.

HOW DID YOU COME TO WORK WITH SHEEP?

In the summer of 1986 my mom and my dad decided to get out of San Francisco. They wanted to find a place that they would be able to retire to. They found our home in Petaluma and at that time it was loosely involved in agriculture; it was down to about 35 acres (14.2 hectares), but it had a veal barn on it and pasture.

By the end of that summer, the grass was over 6 feet [1.8 m] tall and the plan was to figure out what animal would eat the grass for us. We knew my mom was going to be doing most of the work, so we needed an animal that wasn't difficult to handle. We knew nothing about animals at all, save for dogs and cats, and didn't want to start with superexpensive animals—and frankly sheep just fit the bill on all counts.

WHAT WERE THE FIRST CHEESES YOU MADE?

Originally all we made was fromage blanc. Then we added herbs—had three or four different variations of it—and sold that at farmers' markets.

YOUR PARENTS WENT TO ITALY IN SEARCH OF AGED CHEESE RECIPES. WHAT WERE THEY LOOKING FOR?

We wanted a simple recipe because we didn't know what we were doing; we had only made fresh bag cheeses. Fortunately, in general, sheep's milk cheeses are simpler.

HOW SO?

A lot of them have been made for a thousand years, or the recipes are based on cheeses that were made back then and a lot of people in Europe started with sheep or goats, not cows. There were always cow cheeses, obviously, but not in all areas because cows were more expensive and required more land.

I've seen a lot of sheep's milk cheese recipes and by and large they are quite simple. There's a lot you can do to take them in different directions—that's ultimately how we came to San Andreas—but we didn't add a lot of fancy things, like pressing or extensive cooking, because they weren't necessary.

Because of the higher solids you don't have to mess around with as much cooking and pressing—trying to get water out of the curd—as you do with the cow's milk cheeses. Sheep's milk is forgiving and doesn't need a lot of manipulation to do something really delicious.

YOU DON'T PRESS YOUR CHEESES?

We don't have a press or a mill. When we started to work with cow's milk we intentionally went in not wanting to make a pressed cheese because we didn't have a press and we didn't want to add equipment. When we wanted to start making Carmody, our jumping-off point was the recipe we'd been using for our sheep's milk cheese. We tried it with the cow. It didn't work very well and we thought, let's tweak a couple things but let's do it with adjustments in temperature and timing, and ultimately we found something that we liked.

YOU MADE TWO TRIPS TO ITALY. ON YOUR SECOND TRIP WERE YOU ABLE TO ABSORB MORE BECAUSE YOU'D BEEN MAKING CHEESE LONGER?

I was much more comfortable seeing cheeses made. All cheeses are made out of the same products—milk, some sort of a coagulant, salt, maybe you add certain bacteria, and you can approximate cheeses; so seeing any cheese made offers me information even if it's nothing like the cheese I'm going to make. So much about making cheese is how you handle the milk, the timing of it, temperature; how you process the milk, and then the curd, through its stages really does make a difference.

One of the things I figured out on my first trip was—our vat was at floor level like all the pictures of vats we'd seen—when I started going to all these sheep places I noticed all the vats were elevated so that they could roll their table up to the vat and it made it much easier to fill the forms. It occurred to me that was one of our problems; we weren't getting the curd out into the forms quickly enough.

HOW DID YOU CONNECT WHAT YOU SAW WITH THE VATS TO A PROBLEM YOU WERE HAVING AT HOME?

Most of the major flaws that are going to make a cheese not good are related to moisture content—that's the thing that's driving the chemistry. If you're not getting your curd into the forms at the same moisture content beginning to end, you're making multiple cheeses. That's why the larger the vat, the more important and helpful cooking is because the cheesemaker can kind of slow the activity in the curds down so they can get the forms filled and not wind up with different acidity and different moisture content from start to finish.

I was starting to realize some of our problems were dealing with the moisture in the cheeses. We would mix the vat, but the vat would have more clumping once it came time to fill the forms; it was difficult because you had to bail it up onto a table. It was like this fire brigade trying to get all this curd up onto the table and it would be clumping in there. Once I saw someone actually doing sheep's milk where they weren't going to press it, I could see the curds all flowing out individually and I thought the raised vat helped with that.

WHAT OTHER THINGS DID YOU DISCOVER IN ITALY?

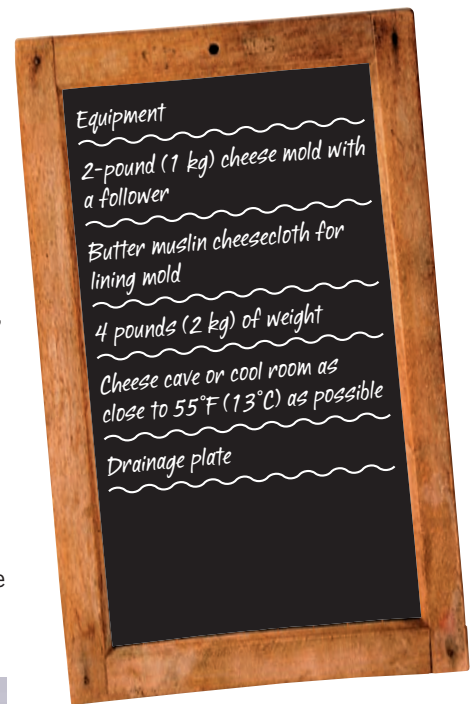
We were watching Gorgonzola being made, and when we were down below seeing the first stage of aging there were some other cheeses in the area, smaller ones on the wall. I asked the cheesemaker about them and he brought one over for us to taste. In Northern Italy they just call it Toma—table cheese. What struck me about this cheese was that it had a lovely mouthfeel, a wonderful smoothness, and a lot of just really nice milk character in the flavor. It wasn't sharp or salty; it was clean, nice and fresh, but aged a month. We thought maybe we could do something like that with Jersey milk—bring out the buttery notes that the Jerseys have and get that mouthfeel.

We never saw it made; we just ate it and when I came home from that trip we started working on our cow's milk table cheese. Since I never saw it made I started from what I knew—our recipe for the Toscano [the cheese that has evolved into San Andreas]—and then we reacted to the good or the bad, tweaking it a little bit, and that became Carmody.

TOMME

Tomme is a rustic cheese whose make procedure is perhaps as simple at it gets for an aged cheese. It is a great introduction to creating an aged cheese, requiring only a round cheese mold, cheesecloth, and a small weight with which to press.

The best aging environment is a converted refrigerator (see page 44, "Aging Cheese at Home"), but it is possible to use a cool basement as well. When using a basement, place the cheese in a container that can be closed to increase the relative humidity. A food-grade storage container with the lid slightly cracked works well. The surface of the cheese will slowly become covered with mold and microflora while it ages. This unattractive surface imparts unique flavors, but you don't want to let it grow out of control. Monitor the cheese and keep the growth in check as described in step 12 on the following page.



An aged Tomme can develop a variety of molds on its surface.

PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Create a water bath from two pots and pour the milk into the inner pot. Heat the water bath until the milk reaches 90°F (32°C).

3 Add the culture to the milk. Mix well. Maintain the temperature at 90°F (32°C) and ripen the milk for 30 minutes.

4 Add the calcium chloride, if using. Dilute the rennet in the water, and then add this to the milk while stirring. Continue to stir for 1 to 2 minutes. Stop stirring and allow the milk to coagulate for 40 minutes, or until a clean break is achieved.

5 Using a large balloon whisk, cut the curds to corn-kernel-size pieces. After cutting, allow the curds to rest for 5 minutes **(A)**.

6 Slowly heat the curds to 95°F (35°C) over 15 minutes, then to 100°F (38°C) in 10 minutes (for a total heating time of 25 minutes). Stir constantly while heating.

7 Maintain a temperature of 100°F (38°C) and continue to stir the curds. The curds will be ready when they have a springy feel when squeezed in your hand. This should take between 5 and 30 minutes.

8 Let the curds settle for 5 minutes, then drain off the whey to the level of the curds. Line a cheese mold with cheesecloth and then scoop or pour the curds into the mold **(B)**. Pack the mold, squeezing in as much curd as possible using your hands **(C)**.

Once the mold is full, fold the remaining cheesecloth over the top of the cheese and place the follower on top. Place about 4 pounds (2 kg) of weight on top of the follower (a 2-quart [2 L]) canning jar three-quarters full of water is close to 4 pounds). Press for 30 minutes **(D)**.

9 Remove the weight and remove the cheese from the mold **(E)**. Unwrap the cheese, flip it over, and then rewrap it in the cheesecloth **(F)**. Replace the cheese in the mold, replace the follower and the weight, and press again for 1 hour **(G)**.

10 Repeat this flipping procedure twice more and press for a total time of 3 to 4 hours. Remove the cheese from the mold and cheesecloth and place in a 55°F (13°C) environment for 3 to 5 hours, or overnight.

11 Soak cheese in a saturated brine solution for 3 to 4 hours per pound (or 6 to 8 hours per kg) **(H)**.

12 Age the cheese in a 55°F (13°C), 70 to 80 percent relative humidity environment for 2 to 3 months. Check the cheese twice a week. As mold and other microflora begin to grow on the surface, wipe it with a cloth dipped in either a saturated brine solution or a mixture of 1 tablespoon (18 g) coarse salt mixed with ¼ cup (50 ml) of white vinegar. This will encourage a healthy natural rind to form and will encourage flavor development. After a few weeks, the rind will develop and you will find you do not need to check the cheese as often.

a Insert whisk at edge of pot, pressing down and pulling around edge of pot and back up.

e Gently push follower to force cheese out of the mold.

b Scoop curds into cheese mold using perforated ladle to expedite draining.

c Press evenly across top to fit as much curd as possible in mold.

d Place mold, follower, and weight atop ridged plate or board to catch whey.

f Unwrap cheesecloth, flip cheese over, and rewrap.

g Snuggle the cheese back in the mold, with loose ends of the cloth at the top. Replace follower and weight.

h Cheese will float in brine. Flip once to ensure all sides are evenly brined.

ASIAGO

Asiago is an Italian style very similar to Tomme style except that it uses thermophilic cultures instead of mesophilic and the curds are heated to a higher temperature. The result is a cheese with a texture that is more elastic and less crumbly.

Traditionally this cheese is produced with a natural rind, just as in the Tomme style. A coat of vegetable ash can be applied to the surface after brining that will neutralize the acidity at the surface and allow slightly different microflora to grow. Another variation is to skip the natural rind and wax the cheese. When using wax you still need to watch for mold growth, but you don't have to wipe down the rind every other day during the first period of aging. You also don't sacrifice an outer layer of cheese in the name of flavor.

This recipe is based on one developed by Debbie Driscoll.

Equipment

- 2-pound (1 kg) cheese mold with a follower
- Butter muslin cheesecloth for lining mold
- Cheese press
- Cheese cave or cool room as close to 55°F (13°C) as possible

Ingredients

- 2 gallons (8 L) whole nonhomogenized milk
- 1/4 teaspoon (1 g) dried thermophilic culture or 4 ounces (120 ml) prepared starter culture (Abiasa Thermophilic Type B or Danisco Choozit TA61 or TA62 are good choices.)
- 1/8 teaspoon (0.5 g) mild to medium lipase (optional)
- 1/4 teaspoon (1 ml) 30 percent calcium chloride solution diluted in 1/4 cup (50 ml) clean water (optional)
- 3/4 teaspoon (4 ml) liquid rennet
- 1/3 cup (80 ml) bottled water
- Saturated brine solution, page 32
- Vegetable ash (optional)
- Cheese wax (optional)

Slabs of Asiago can be consumed as is, grated and melted into a pasta dish, or sandwiched between rustic wheat bread for a satisfying grilled cheese sandwich.

PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Create a water bath from two pots and pour the milk into the inner pot. Heat the water bath until the milk reaches 90°F (32°C).

3 Add culture to the milk. Also add the lipase, if using. Mix well. Maintain the temperature at 90°F (32°C) and ripen the milk for 45 minutes.

4 Add the calcium chloride, if using. Dilute the rennet in the water, and then add this to the milk while stirring. Continue to stir for 1 to 2 minutes. Stop stirring and allow the milk to coagulate for 45 minutes, or until a clean break is achieved.

5 Cut the curds with a curd knife to ¼" (6 mm) cubes. After cutting, allow the curds to rest for 5 minutes.

6 Slowly heat the curds to 115°F (46°C) over 60 minutes, no more than 2°F (1°C) every 5 minutes. Stir once a minute while heating.

7 Let the curds settle for 5 minutes, then drain off the whey to the level of the curds. Line a cheese mold with cheesecloth and then scoop or pour the curds into the mold. Pack the mold, squeezing in as much curd as possible using your hands. Once the mold is full, fold the remaining cheesecloth over the top of the cheese and place the follower on top. Place about 3 pounds (1.5 kg) of weight on top of the follower (a 1-quart [1 L] canning jar filled with water is close to 3 pounds). Press for 30 minutes.

8 Remove the weight and remove the cheese from the mold. Unwrap the cheese, flip it over, and then rewrap it in the cheesecloth. Replace the cheese in the mold and replace the follower. Increase the weight to 6 pounds (3 kg) (a 2-quart [2 L] canning jar filled with water is close to 6 pounds) and press 18 to 24 hours.

9 Remove the cheese from the mold and cheesecloth. Soak cheese in a saturated brine solution for 12 hours (or 6 hours per pound).

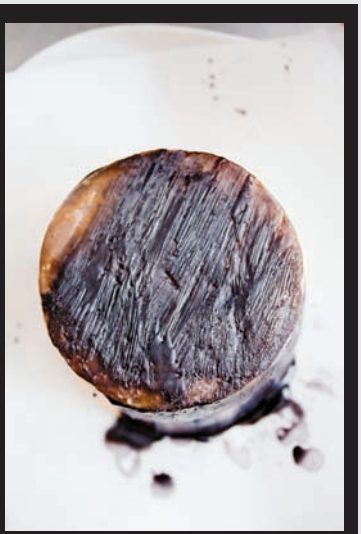
10 Remove the cheese from the brine and allow the cheese to dry for 2 days.

11 This cheese can be aged with a natural rind, with an ash rind, or sealed in wax (see "How to Wax Cheese"). If an ash coat is desired, either sprinkle vegetable ash on the cheese or roll the cheese in a thin layer of ash.

For a natural rind, simply scrub the rind with a brush during aging to keep surface bacterial growth.

12 Age the cheese in a 55°F (13°C), 70 to 80 percent relative humidity environment for 2 to 3 months. Check the cheese twice a week. If excessive mold begins to grow, wipe the surface with a cloth dipped in a saturated brine solution (if using ash, reapply some ash to the wiped surface).

If using vegetable ash, generously sprinkle entire exterior of the wheel prior to aging.



HOW TO WAX CHEESE

Before waxing, the cheese's surface must be dry or the wax will not adhere well.

To wax the cheese, melt cheese wax in an old saucepan or in a slow cooker. It is best to use a vessel dedicated to cheese waxing, because the wax is very difficult to remove. Use an inexpensive paintbrush to apply melted wax in thin layers to the cheese surface. Approximately three thin layers of wax is sufficient.

The wax layer prevents mold on the cheese by sealing out oxygen that mold requires to grow. If the wax cracks or if there is a pocket of air, a mold colony may form. It is helpful to use a light-colored wax and to keep the wax layer thin so you can see any such mold. If mold sprouts, cut off the affected portion of the cheese and rewax the open surface.

CHAPTER 6: WASHED CURD AND PRESSED UNDER THE WHEY CHEESE

Pressure in psi/kPa	Pounds to apply to 4" round mold	Kilograms to apply to 10 cm round mold	Pounds to apply to 6" round mold	Kilograms to apply to 15 cm round mold
0.8/5.5	10	4.4	23	9.9
1.2/8.2	15	6.6	34	14.8
1.6/11.0	20	8.8	45	19.8
2.0/13.7	25	11.0	56	24.7
2.4/16.5	30	13.2	68	29.7
3.2/21.9	40	17.6	90	39.5
4.0/27.4	50	22.0	113	49.4
4.8/32.9	60	26.4	135	59.3
5.6/38.4	70	30.8	158	69.2
6.4/43.9	80	35.2	180	79.1
7.2/49.4	90	39.5	203	89.0
8.0/54.9	100	43.9	225	98.9
20/138	250	110.0	570	249.0
40/275	500	220.0	1,100	497.0

Washing curd and pressing under the whey are two techniques that can be used during cheese making prior to draining. Washing curd is exactly what it sounds like: The cheesemaker drains a portion of the whey from the vat and replaces it with the same volume of water. The intent is to remove lactose, the food source for lactic bacteria, so that lactic bacteria cannot continue metabolizing the sugar into lactic acid; the resulting curd has a lower acidity, a sweeter flavor, and slightly higher moisture because the curds absorb some of the diluted whey.

Cheeses that are pressed under the whey will also have a flexible texture like washed-curd cheeses; the lack of air pockets or bubbles makes the paste less prone to breaking. To press under the whey, the cheesemaker places heavy metal plates on top of the curds in the vat before draining the whey. The pressure of the plates encourages the curds to knit together and reduces air bubbles and pockets within the paste. Once the plates are lifted, the mass of curds is cut into squares, lifted out of the vat, and nestled into forms. Pressing under the whey is also called prepressing.

BASICS OF PRESSING

When a cheese needs to be pressed, the amount of pressure to be used is specified in either pounds per square inch (psi), or the metric equivalent in kilopascals (kPa). This pressure must be converted to a weight or force to apply to the follower on top of the cheese mold. To convert, multiply the specified pressure by the surface area of the follower. Therefore, if you are using a larger cheese mold, it takes more weight to achieve the same pressure.

The chart above shows the conversion between various pressures and the amount of weight to use for different sizes of round cheese molds. It is not necessary to be extremely precise when using this table. In other words, the difference in the final cheese between using 10 pounds of weight versus 12 pounds, or 4.4 kilograms rather than 5.4 kilograms, is not noticeable.

SEASONAL CHEESE MAKING

Seasonal dairying and cheese making can mean a number of different things. Some small cheesemakers breed all their animals at the same time, often at the end of fall or winter, so that they will all be dry at the same time and give the farmer a break from cheese production before the animals give birth in the spring. Some of these farmers make aged cheeses in an attempt to stagger sales so that they have income throughout the dry months.

Individual cheeses can be also be called seasonal if they are only made during a specific time of year. This can be for cultural reasons, similar to breads or sweets that are made only for specific holidays, but more often it is driven by some characteristic of the milk that is particularly good for a specific kind of cheese. One of the best examples of this is Beaufort Alpage, the prized version of Beaufort that is made only during the summer months when cow herds are taken up into the Alps to graze on wild alpine pastures, which influence and enhance the flavors in the milk and thus the cheese.

Steaming whey flows out of the cheese vat and through a screen to catch tiny bits of curd before the liquid goes into the floor drains at Meadow Creek Dairy.

Cheesemaker Helen Feete pours curds into square molds to make her luscious washed rind cheese called Grayson.

HELEN FEETE,
CO-OWNER AND CHEESEMAKER, MEADOW CREEK DAIRY, GALAX, VIRGINIA, USA

Helen and Rick Feete got into dairy farming in the 1980s for lifestyle reasons; they wanted to spend more time with each other and their young children. Lacking the massive funds needed to build a conventional dairy, the Feetes went an alternative route, creating a cow dairy based on rotational grazing. After six years of trailblazing they had good pasture and a solid herd, but they were exhausted and decided to try operating seasonally. The annual winter "breaks" this system offered gave the Feetes time to build a small cheese plant, and Helen began transforming their beautiful, grass-based milk into cheese. Today she makes three award-winning cheeses with milk from their herd of one hundred cows.

DID YOU SWITCH TO A SEASONAL OPERATION WITH YOUR DAIRY BEFORE OR AFTER YOU STARTED MAKING CHEESE?

Before. We were committed to seasonal dairying for what it did for us, the cattle, and the land. It's more difficult to be a seasonal cheesemaker, but we're so determined to stay that way that I've made it work for me.

WHAT ARE THE BENEFITS TO THE CATTLE OF OPERATING SEASONALLY?

You're following a natural cycle with the grass—their main input. They calve and their highest peak nutritional needs are when the grass is there for them instead of having to try and create a diet that will be healthy for them in a season when you don't have that grass. We have the peak of their milk hit when they have their best nutrition off the land and then we don't have to supplement as much.

The other ways that it helps are smaller things I'm sure you wouldn't see without being in the dairy business. They all calve at the same time, so we can focus, get our heads into it, take good care of the calves, and then it's over. Every year we have eight to nine months where we can let those facilities sit with no calves in them. That really helps break a disease cycle too; we can move, clean, and sanitize the hutches because we have a break.

WHAT ARE SOME OF THE CHALLENGES OF BEING A SEASONAL CHEESEMAKER?

The big challenge is how much your milk changes. When a cow goes through a lactation, her milk is going to change. When she calves, she's putting out lots of milk, trying to feed that calf—that's what is in her genetics—and then she's going to give a little bit less milk and it's going to be higher in solids as she goes through her lactation. That's not a big deal until you have eighty cows doing the exact same thing at the same time.

When I start in the spring, my solids will be lower; then they increase, which completely changes the milk. The fall milk is the hardest; it's got a lot more solids and fat, which makes it want to hold moisture. I have to work to drive the moisture out so that the cheeses will keep well.

HOW DID YOU FIGURE THOSE THINGS OUT? WAS IT THROUGH TESTING THE MILK TO SEE WHAT THOSE COMPONENTS LOOK LIKE?

We have almost always had our solids—like your butterfat and your protein—because we've sold milk commercially for so long. When you sell milk commercially you get those components back automatically because that's how you're paid. That's one thing that you watch, but the rest is the cheese. When I got Grayson going I couldn't figure out why I could get it to keep so long—like six months—which it doesn't now because I make it better. It was because I was retaining too much moisture and that made it age slower.

Large metal plates are placed on top of the curd in the vat to press them together and keep them submerged in the whey.

THE FIRST CHEESE THAT YOU MADE WAS THE APPALACHIAN OR THE GRAYSON?

Appalachian. Long ago Appalachian was a Jack and I used to wash it. When you wash the curd you reduce the lactose and for something like Jack or Gouda that keeps you at a high pH. A lot of cheesemakers wash the curd because they have trouble controlling acid, and if you wash the curd it's an easy way to bring it back under control.

ARE THERE THINGS THAT MAKE IT DIFFICULT FOR A CHEESEMAKER TO CONTROL ACID?

Controlling acid is very difficult; it's something you improve at. You don't want to build it too fast and it depends on the cheese you're making.

WHY DID YOU STOP WASHING THE CURD FOR APPALACHIAN?

Because I knew it washed out flavor. If you're not careful it can really take your profile down. You get a higher pH and wash some of that lactose away.

THINGS TO CONSIDER BEFORE WASHING CURD

Be sure that your water source is clean and free of potentially harmful bacteria; the simplest way to do this at home is to use distilled water. The main concern here is *Pseudomonas fluorescens*, a spoilage bacteria that can develop on the rind and create bitterness and putrid aromas.

Some flavor characteristics of your cheese may be lost because a portion of the flavor-creating molecules will be washed away.

IS IT TEMPTING TO CHANGE A BUNCH OF THINGS AT ONCE, ESPECIALLY WHEN YOU'RE STARTING AND YOU DON'T KNOW WHAT IS CAUSING A PROBLEM?

It's the worst thing you can do. It is very hard to only change one thing. Especially if you know something is wrong. Like I'll know that either I'm not building acid fast enough or I'm building it too fast—well there are four or five variables I could change to change that around.

YOU SAID TWO THINGS THAT SOUND LIKE THEY WOULD CAUSE THE SAME PROBLEM—BUILDING ACID TOO FAST AND BUILDING TOO MUCH ACID. ARE THEY DIFFERENT?

Acid you build early is going to be exponential. The more acid I build when I'm ripening the milk, it's going to build more throughout the make than if I would build during cook. Where you build it makes a difference and whether you build it by using temperature or you build it by not cutting it small, or by using more cultures, all those will make it slightly different. Once you cut your curd, it's harder to get that moisture out.

I THOUGHT THE BIGGEST OPPORTUNITY TO GET MOISTURE OUT WAS WITH TOOLS LIKE CUTTING AND COOKING.

It is, but if you have a lot of fat in your milk then when you go to coagulate and it makes that curd structure, it wants to trap moisture in there. You can get that out by cutting small and cooking high, but with the Grayson I don't do a lot of cooking or manipulation in the vat so it is more challenging.

WHAT IS THE PURPOSE OF PRE-PRESSING?

What I'm trying for is a tight curd structure, not a lot of holes, not a lot of openings. Pre-pressing under the whey helps force the air out and it also makes it a lot easier to hoop because you can just cut those compacted squares and drop them in hoops. If you do it either by gravity or pumping, you're going to actually incorporate air in when you take that curd out of the vat.

WHAT'S THE PURPOSE OF PRESSING AFTER IT'S OUT OF THE VAT?

It's more about getting a good, smooth rind—all I use are weights and gravity to press, and what I'm after is just a smooth outer shell. A cheese like Cheddar takes the most physical pressure because it builds so much acid during the make that the curd doesn't want to fuse together, so you have to force it together.

WHAT INFLUENCED YOUR DECISION TO MAKE RAW MILK CHEESES?

I feel like it has the most potential. If you're very careful and you don't mess anything up, you have a lot of potential—if you learn to make cheese well enough—to make a really outstanding cheese. I've got this special milk from this herd that Rick has worked with the genetics on for years and I think keeping it raw offers the most potential.

ARE THERE TOOLS THAT YOU SEE AS INDISPENSIBLE?

I have a love–hate relationship with my pH meter. It has been a thirteen-year battle—figuring out when it's important to use it, what it can tell you, and when you're wasting your time. It's an excellent tool, but it's taken me a long time to learn to use it as a guideline instead of black-and-white; if the pH does the same kind of thing three or four days in a row, then I start to believe it.

If I'm a minute late, that curd could be a bit brittle, it could shatter, it could try to hold too much moisture. We stand over the vats like a hawk when it's time to cut.

HAVE YOU DEVELOPED SENSORY SKILLS SO THAT YOU DON'T HAVE TO RELY ON THAT METER SO MUCH?

Until it's curd I can't tell a thing by looking at it. When you culture and you're waiting to rennet is when my pH meter is the most important. I want to see the pH drop because the bacteria, when you put your culture in, is going to go through that lag and log phase where it takes a while and then it starts growing quickly—you can't see that. You can learn it by time if your milk is the same, but mine isn't. I could probably make cheese without the meter the rest of the make.

JUST BY WATCHING AND FEELING?

Yeah. To feel the break to know when to cut it, and with mine a minute can be a big deal. If I'm a minute late, that curd could be a bit brittle, it could shatter, it could try to hold too much moisture. We stand over the vats like a hawk when it's time to cut.

IF YOU DO REALIZE THAT YOU'RE A LITTLE LATE, ARE THERE ADJUSTMENTS YOU CAN MAKE?

Well, there are a couple of things—and my knowledge is pretty much all around washed rinds. In the cellar, a cheese that has retained too much moisture early on in its life might be just a little bit shiny. There are things that you can do to that rind to help it use up that lactose. I can change the balance of some of the things in the wash and that can change it a little.

Equipment

- 2-pound (1 kg) round cheese mold
- Butter muslin cheesecloth
- Vacuum sealer (optional)
- Cheese cave

HAVARTI

Havarti is a northern European washed curd cheese. It is traditionally not pressed, and so small spaces that exist between the curds when they are molded will remain in the cheese and become small eyes. It is a good cheese to make if you do not have a cheese press.

Sometimes spices are added to enhance the flavor of the cheese. When you use spices in cheese making you need to make sure they do not infect the batch with unwanted bacteria. The easiest way to wipe out any stray bacteria is to steep the spice in boiling water for a few minutes before adding it to the milk.

Ingredients

- 2 gallons (8 L) whole nonhomogenized milk
- 1/4 teaspoon (1 g) dried mesophilic culture or 4 ounces (120 ml) prepared starter culture (Danisco Choozit MM100 or MA4001 are good choices.)
- 1/2 teaspoon (1.3 g) dried spice such as cumin, caraway, or fenugreek (optional)
- 1/4 teaspoon 30 percent calcium chloride solution diluted in 1/4 cup (50 ml) clean water (optional)
- 1/2 teaspoon (2.5 ml) liquid rennet
- 1/4 cup (50 ml) bottled water
- Saturated brine solution

Havarti flecked with caraway seeds makes a flavorful addition to sandwiches or as a snack on its own.

PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Create a water bath from two pots, and pour the milk into the inner pot. Heat the milk to 86°F (30°C). While milk is heating, dissolve the cultures in ½ cup (100 ml) of milk. If using spices, put them in a small bowl with enough water to cover and microwave them on high a short time (30 seconds) until the water boils (if you do not have a microwave, simply cover the spices with ¼ cup [50 ml] of boiling water).

3 Add the culture and the spices (if using) to the milk. Mix well. Maintain the temperature at 86°F (30°C) and ripen the milk for 30 minutes.

4 If using, mix the calcium chloride with ¼ cup (50 ml) of clean water, then add it to the milk and mix well.

5 Dilute the rennet in ¼ cup (50 ml) of bottled water, and immediately add to the ripened milk. Stir for 1 to 2 minutes. Allow the milk to coagulate for 30 minutes.

6 Check the milk for a clean break. If the milk is not yet firm enough, wait 10 minutes longer and check again. Once a clean break is achieved, cut the curds into ½" (1.3 cm) cubes. Allow the curds to rest for 10 minutes, then stir for 5 minutes.

7 Remove whey until approximately 25 percent of the initial volume has been removed **(A)**. If not enough whey has expelled to meet this amount, stir the curds gently to encourage more expulsion. Replace the removed whey with an equal amount of hot water at 115°F (46°C) (hot tap water is usually close to this temperature) and stir. This is the process of washing the curds **(B)**.

8 Warm the temperature of the water bath to 98°F (37°C). While warming, stir the curds and then check their temperature. Adjust the water bath so the curds reach a target temperature between 96°F and 98°F (35.5°C and 37°C). Continue to stir the curds gently for 40 minutes.

9 The curds will be ready to drain once they grip the palm of your hand when squeezed **(C)**. Allow the curds to settle, and then pour off as much whey as possible. Line a 2-pound (1 kg) cheese mold with cheesecloth and then ladle or pour the curds into the mold. Lay the remainder of the cheesecloth over the top of the curds. Allow the cheese to drain for 30 minutes.

10 Remove the cheese from the mold, unwrap it, then carefully turn it over and rewrap with the cheesecloth. Slide it back into the mold. Allow the cheese to drain for 1 hour.

11 Repeat the unwrapping and turning process. Allow the cheese to drain for 2 hours.

12 Unwrap and rewrap one more time and then allow the cheese to drain overnight.

13 The next day, unmold the cheese and soak it in a saturated brine solution for 1 to 3 hours.

14 After brining, place the cheese on a clean cutting board or bamboo mat and allow the cheese to air-dry in a cool environment (50°F [10°C] is ideal) until the surface is dry to the touch. This could take from 6 to 48 hours depending on the environment. Turn the cheese once or twice during drying.

15 Vacuum seal the cheese in plastic using a FoodSaver or similar appliance. Waxing the cheese or wrapping it tightly with plastic wrap is another option, but the cheese will need to be monitored carefully for mold growth during aging. Vacuum sealing assures there are no pockets of air at the surface of the cheese where mold can grow **(D)**.

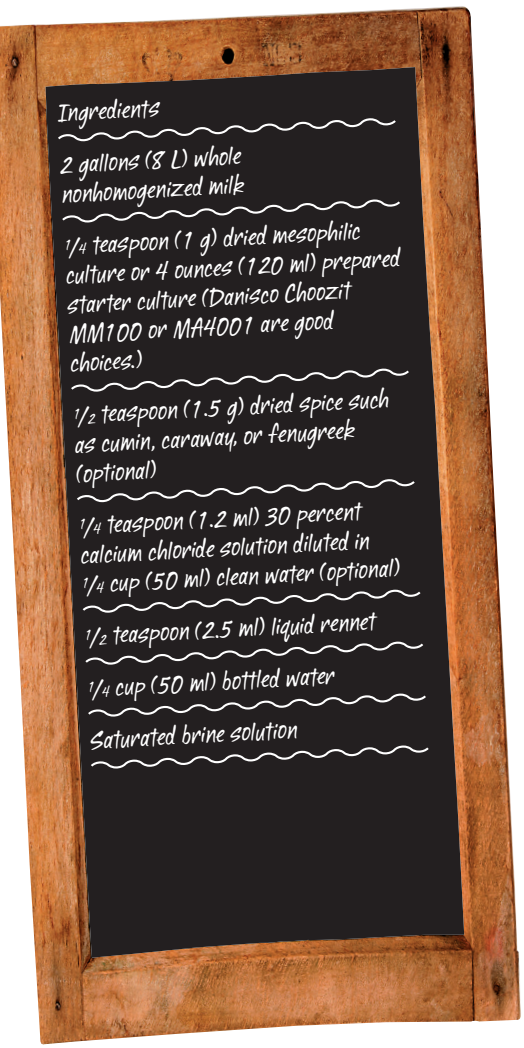
16 Age the cheese at 55°F to 60°F (13°C to 15.5°C) for 3 to 4 months. Because the cheese is sealed, the relative humidity of the environment is not critical.

a Bail out whey, keeping track of amount removed.

b Replace with an equal amount of hot water and stir to distribute.

c Check curd readiness by squeezing in palm to see if it holds together.

d Slide wheel into vacuum seal bag and seal.



Gouda can be sliced for serving or, for longer aged wheels, broken apart into small chunks.

GOUDA

Making Gouda is identical to Havarti except that the curds are pressed after being placed in the cheese mold. Spices can be added just as in the Havarti recipe, with the same caveat that they need to be sterilized before use.

Gouda can have eyes as well if the starter culture has gas-producing bacteria. In Havarti any gas produced by the culture would probably make its way out of the cheese through the open texture of holes, but in Gouda it is trapped within the cheese and forms eyes. The eyes are fewer in number but tend to be larger than those of Havarti.

PROCEDURE

1–9 Follow the same steps as the Havarti method, but instead of letting the curds drain for 30 minutes in step 9, place the follower on top of the wrapped curds and place the cheese mold into the cheese press **(A)**.

10 Press the cheese at 1.6 psi (11 kPa) (20 pounds [9 kg] of weight for a 4" [10 cm] round mold) for 20 minutes. See page 72 for pressing weights.

11 Remove the cheese from the mold, unwrap it, turn it over, rewrap it, replace it in the cheese mold, and place the follower on top. Press at a pressure of 3.2 psi (22 kPa) (40 pounds [18 kg] of weight for a 4" [10 cm] round mold) for 3 hours.

12 Remove the cheese from the mold and soak it in a saturated brine solution for 1½ to 2 hours.

13 After brining, place the cheese on a clean board or bamboo mat and allow the cheese to air-dry in a cool environment (50°F [10°C] is ideal) until the surface is dry to the touch. This could take from 24 to 72 hours depending on the environment. Turn the cheese once or twice during drying.

14 Seal the cheese by wrapping tightly with plastic wrap, vacuum sealing (see Havarti recipe), or waxing (see Asiago recipe).

15 Age the cheese at 50°F to 55°F (10°C to 13°C) for 3 to 4 months. Since the cheese is sealed, the relative humidity of the environment is not critical. Check the cheese once a week for unwanted mold growth.

a Place load-bearing arm of press in the center of the follower, then add weights to press.

Earthy flavors of traditional clothbound Cheddar are perfectly balanced by savory sweet cherry tomatoes.

CHAPTER 7: CHEDDAR CHEESE

Cheddar is one of the most recognized cheeses around the world. The basic techniques and recipe for Cheddar originated in a town of the same name in South West England, a region where a number of traditional examples are still in production. Although not a requirement, Cheddar is generally a larger format cheese with blocks weighing 40 pounds (18 kg) or more, and wheels ranging from a 16-pound (7.2 kg) truckle on up to a 74-pound (32.7 kg) mammoth. There is a rich history of Cheddar making not only in the United Kingdom but also the United States, Canada, and New Zealand.

The term *Cheddar* is unique because it not only refers to the town of origin and describes a category of cheese, loosely defined as it may be, but it is also a verb that describes a technique that continues to be used in some commercial Cheddar production. Cheddaring is a technique where the curds are cut and cooked slightly before the whey is drained. After draining, the curds are allowed to mat and are then manipulated into evenly sized rectangular slabs, and these rectangles are stacked and restacked on top of each other to expel more whey and also allow time for the acidity to increase. The rectangles flatten and stretch out until they resemble giant strips of taffy. Once the target acidity is reached, the slabs are fed through a curd mill that produces finger-sized chunks of curd that get salted before being scooped into molds and pressed at high pressures.

WHY IS SOME CHEDDAR ORANGE?

The coloring additive that gives Cheddars that orange color is called annatto, an extract from achiote trees found in Latin American countries and also throughout the Caribbean. Allegedly, British cheesemakers began to use annatto in the 1800s to give their cheeses the rich yellow hue that consumers associated with cheeses made from the milk of cows that had consumed ample pasture. Prior to using annatto, producers had used other vegetable dyes for similar purposes.

Today annatto is used in a handful of traditional cheeses such as Britain's Red Leicester and France's Mimolette, and also in a number of industrial Cheddars. In Latin America and the Caribbean, annatto is found in a number of recipes, presumably for purposes of color; though some tasters claim they can taste annatto in cheese, most experts deem it a flavorless coloring agent.

Slabs of curd undergo cheddaring at Beecher's Handmade Cheese.

After being flipped and stacked, cheddared slabs rest acting as a press for one another and giving the bacteria time to multiply and increase the acidity.

Once cheddaring is complete, slabs of curd are fed through a mill to break them into finger-sized rectangles.

WHY IS CHEDDAR OFTEN MADE IN SUCH BIG WHEELS AND BLOCKS?

In Britain there are two regions that have long been known for their grass production: Somerset and Cheshire. They've got the highest rainfall, the agriculture is definitely grass based, and they can't grow very high crops of wheat because of the summer rains that lead to disease in the wheat. Cheshire and Somerset have always had really good ground for growing quality grass. They developed the skills that enabled them to turn it into large amounts of milk.

Cheshire and Cheddar are the two largest cheeses in the United Kingdom and both originated in these regions. These larger wheels most likely developed because the farmers were often tempted to have more than one cow because they had miles of lush grass—that left them with a lot of milk to play with. The logic easily follows that if they were going to make one cheese, especially just one cheese per day, it would be quite a big one.

Jamie Montgomery stands in the midst of the Cheddar stores at the Montgomery farmstead.

JAMIE MONTGOMERY,
CHEESEMAKER, MONTGOMERY'S CHEDDAR, NORTH CADBURY, ENGLAND

Montgomery's Cheddar is legendary and a reminder of the payoff that comes from the commitment to preserving salient traditional practices. Ever humble, Jamie Montgomery noted that our conversation began with him saying his family had been making Cheddar for one hundred years—his grandfather purchased the farmstead in 1911—and finished with him saying, "God, I've got so much to learn." His family's dedication gives us hope for centuries of glorious clothbound Cheddar to come.

WAS THERE AN IDEOLOGY OR FIRM PRINCIPLE THAT LED YOUR FAMILY TO COMMIT TO MAKING UNPASTEURIZED CHEESE?

Clearly there is now. That's an easy answer now that people care, but there was certainly a dark period through the '60s, '70s, '80s when nobody understood unpasteurized Cheddar or cared much. Did my grandpa know that one day unpasteurized cheese would be worthwhile? I don't think so. But he believed strongly in being a master of his own product, and he was a good enough farmer to know that he was doing a good thing.

IS IT CHALLENGING THAT THE NAME CHEDDAR REPRESENTS SUCH A SPECTRUM OF CHEESES?

Cheddar as a cheese was very unfortunate, wasn't it? It was so unlucky to be a cheese made within an empire-forming governance and a cheese that everybody with their view toward being international said, "Wow, that would be a really good cheese to be able to make industrially." Now, whether what everybody else is calling *Cheddar* is really Cheddar is too late for us to argue.

SO YOU ARE DEFINING WHAT YOU DO WITH THE WEST COUNTRY FARMHOUSE CHEDDAR PDO (PROTECTED DESIGN OF ORIGIN), AND THE ARTISAN SOMERSET CHEDDAR PRESIDIUM INSTEAD OF TRYING TO ARGUE THAT WHAT SOMEONE ELSE DOES IS *NOT* CHEDDAR?

It's too late. And to flip it on its head a lot of people have said to me, "Really James, what you ought to do is stop calling yours Cheddar and come up with some other name for it." They have a point there because the association is so bad, but that would be letting all the other makers off the hook—all these people that are making this stuff and calling it Cheddar—we need to be there just to remind them what charlatans they really are.

WHAT DO YOU THINK OF STIRRED CURD CHEDDAR?

Given that the word *cheddar* in terms of cheese is not a noun, it's a verb, it's a process—the stacking of the curds, the cutting into blocks and putting one on top of the other and leaving them there for a decent amount of time, and turning them over in order to get a change in the texture of the cheese—that is a verb, to *cheddar*. So if you don't cheddar it, is it Cheddar? Does that answer your question?

I CANNOT SEEM TO FIND ANYTHING ABOUT THE CHOICE TO BANDAGE A WHEEL WITH CLOTH BEYOND THAT IT WAS A MEASURE OF PEST CONTROL. WHY DO YOU STILL DO IT?

I found that question inspiring because it made me question it myself. That pest control bit of it I'd forgotten—I had known it, but I'd forgotten. You're aware of the problems we have with mite now—once a mite gets involved within the cloth there's nothing we can do about it. We certainly can't use any water to give them a more difficult environment to live in.

YOU CAN'T WASH CLOTHBOUND CHEDDAR BECAUSE THE CLOTH WILL HOLD THE MOISTURE TOO MUCH?

Exactly, the cheese will rot underneath it. If we have a drip from the ceiling or something it's absolutely lethal to the cheese. That sort of flips the argument that the cloth is there to repel mites because—I've come to have this sort of love–hate relationship with the cloth—it appears just to be there to simply make it more difficult to deal with the mite.

We've all got different theories about what cloth is there for, and on how to deal with mite. Other producers have been finding some success with a product that is a mined mineral—from seas that were laid down millions of years ago that we call *diatomaceous* earth. It's the fossilized remains of plankton—tiny animals that are spiky on a very small scale. It's a naturally occurring, food-safe product that has been tested and is commonly used in grain stores. When the mite brush up against this product—a very fine powder—it breaks their skin. They are fragile, and their skin is incredibly easy to break. They're almost impossible to kill in any other way, but if you can scratch them they will dry out and die.

I don't like the idea of using lots of this stuff on the outside of the cheese, rubbing it and having it in the atmosphere. I fear that it changes the nature of the skin of the cheese—makes an extra coat on the cheese—and doesn't allow the cheese to breathe in the same way, which I think is crucial to the type of flavor I'm after.

Now, whether what everybody else is calling Cheddar is really Cheddar is too late for us to argue.

Think about it in terms of keeping cattle in a field. If you have plain wire fence and the cattle are trying to push their way through it—it is a fence, but it only has a certain amount of effect. If you change that plain wire for barbed wire, the cattle have got to accept damage to themselves to get through that wire. I'm looking at this thinking, what if we could turn the plain wire of a cloth into barbed wire? What if we could get the diatomaceous earth into the fabric of the cloth?

SO IT WOULD STILL HAVE AN OPENNESS?

Yes. So we've mixed the powder into the lard that we use as a glue to stick the cloth on with—as a trial.

AT ANY POINT IN THE MATURATION OF A DRUM OF CHEDDAR CAN YOU REBANDAGE IT?

My belief is that the drying and the breathing are massively important. There was a batch of our cheese I came across in our store and as I unwrapped it I was aware straight away that even at twelve months a lot of lard was still under the cloth. It was strikingly more than I ever see—and then I tasted the cheese and it seemed very moist, rather green and acid, and from my point of view, it didn't taste like our cheese at all. There's no way I'm saying this is all of the answer—but if you put a lot of lard on and stop it from breathing, you get a different cheese. There's no doubt about that.

So the notion of waiting for the lard to be eaten off by all of the molds that we like to have in our store and then saying, "All right, we're going to stick a lot more lard on it," is not the notion of having a clothbound cheese to me. The whole reason for having a clothbound cheese is to let it breathe; the reason for having molds in the store is to remove that lard. That's the point.

I DIDN'T KNOW THAT THE MOLDS CONSUMED THE LARD.

They consume it, leaving a slightly white, almost powdery residue. If you put too much lard on and the molds do such a good job eating the lard, what you finish up with are cavities under the cloth, and that to me is a bad thing. I'm interested in getting the cloth in good contact with the surface of the cheese. Because the cavities can end up damp and you get problems with the rind. My preferred method is to dip the cloth into a fairly molten lard so it's quite a thin coat; we preimpregnate the cloth with the lard.

DO YOU THINK THAT BITS OF BLUE MOLD IN THE PASTE OF CHEDDARS ARE FLAWS?

We work for it not to happen, which makes it quite difficult to entirely defend the notion that it's not a flaw. If it wasn't a flaw we wouldn't do anything to prevent it. I try to do various things in order to make a rind as well as we can, but at the same time I'm not prepared to go out of my way to seal it to the point that I'm not making a traditional Cheddar. If I'm going to do that I might as well just stick it in a plastic bag and be done with it.

Finished clothbound wheel of Cheddar ready for further aging

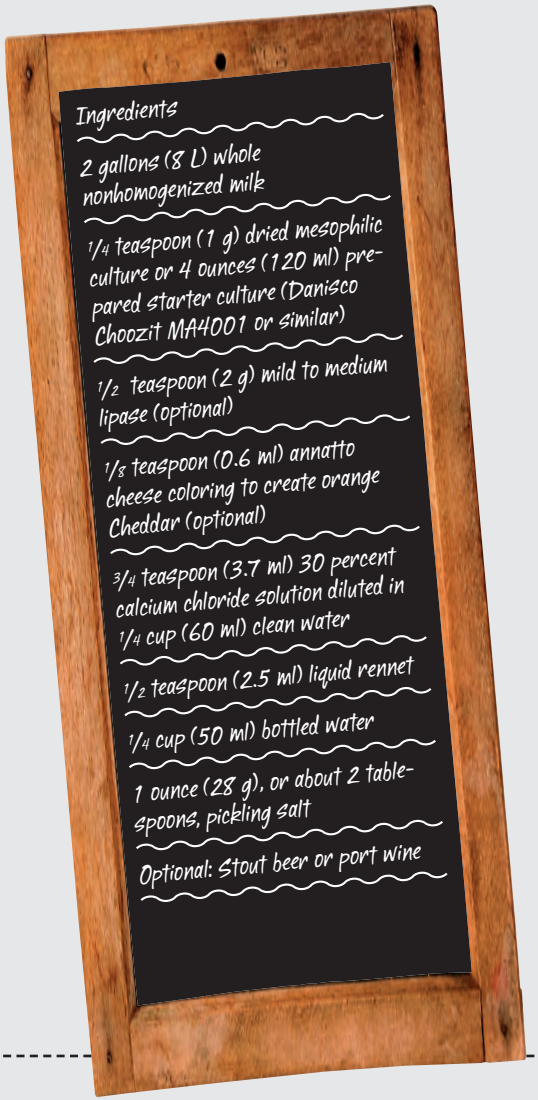
CHEDDAR
(STIRRED CURD)

When making small batches, the home cheesemaker doesn't have enough curds to stack high and duplicate the traditional cheddaring process. So instead we must use the stirred curd cheddaring method where stirring promotes release of whey and the curds develop a firm, springy texture that is comparable to the texture of cooked chicken breast. This method still produces outstanding cheese, which some argue can be just as good as Cheddar created by the traditional method.

After draining, the curd is milled (broken into chunks), salted, and then pressed. Ideally, Cheddar should be pressed with pressures near 40 psi (275 kPa), which can be difficult for the home cheesemaker to achieve. For example, for a 4" (10 cm) round mold this would mean 500 pounds (227 kg) of force on top of the cheese! Use good judgment and press with as much force as can be safely supplied with your press; the cheese will still be Cheddar.

If you have ever visited a commercial cheesemaker that makes Cheddar, you may have had Cheddar cheese curds (which notoriously squeak when you chew them). These are Cheddar curds before they are milled, and you can make your own by following the recipe that follows and stopping at step 10. Salt the curds to taste before serving them.

This recipe is based on one published by Peter Dixon.



PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Using two pots to create a water bath, heat the milk to 88°F (31°C).

3 Add the culture to the milk. If using lipase, add it as well. Mix well. Maintain the temperature at 88°F (31°C) and ripen the milk for 40 minutes.

4 If using annatto, add it and stir to combine. Ripen for 15 minutes longer (this allows more acidity to develop to compensate the alkalinity of annatto).

5 Mix the calcium chloride in ¼ cup (50 ml) pure water, then add this to the milk and mix well.

6 Dilute the rennet in ¼ cup (50 ml) of bottled water. Add the diluted rennet to the milk and stir for 1 to 2 minutes. Allow the milk to coagulate for 30 minutes.

7 Check the milk for a clean break. If the curd is not yet firm enough, wait 10 minutes and check again. Once a clean break is achieved, cut the curds into ½" (1.3 cm) cubes, then allow the curds to rest for 5 minutes **(A and B)**.

8 Slowly warm the curds to 102°F (39°C) over 45 minutes, stirring gently and continuously. The curds should shrink to the size of peas or beans **(C)**.

9 Hold the temperature at 102°F (39°C), stirring from time to time, for 30 to 45 minutes or until the curds are springy and feel like pellets (if using a pH meter, the pH of the whey should be between 6.1 and 6.2).

10 Allow the curds to settle, and then pour off as much whey as possible. Line a colander with cheesecloth and pour the curds into it. Return the curds to the pot and maintain heat at 102°F (39°C), stirring the curds every 5 minutes, for about an hour. Remove whey as it collects. The curds are ready when they have a firm texture similar to cooked chicken breast (the pH at this point should be between 5.3 to 5.4) **(D)**.

11 Optional: At this point you can add either 12 ounces (350 ml) of stout beer for stout Cheddar, or 2 cups (475 ml) of port wine for port wine Cheddar. After 30 minutes, drain the liquid and continue.

12 Strain the curds into a cheesecloth-lined colander. Break the curds up into chunks no larger than 1" (2.5 cm) with your hands and place them back in the pot. Add the salt, stir to combine, and then let them sit for 10 minutes.

13 Fill a cheesecloth-lined cheese mold with the curds. Place cheese mold in a cheese press **(E)** and press at half of the maximum pressure of your press, up to 20 psi (138 kPa), for 30 minutes **(F)**. Unwrap, flip cheese, rewrap, and press another 30 minutes at the same pressure. See page 72 for pressing weights.

14 Rewrap the cheese and press at the maximum pressure for your press, up to 40 psi (276 kPa), for 12 hours.

15 Remove the cheese from the press and let dry at room temperature for 1 to 2 days, turning once or twice. The cheese should be dry to the touch.

16 Seal the cheese by vacuum sealing, waxing, or cloth binding. Age the cheese for 3 months at 50°F (10°C). To develop sharper flavor in the cheese, age for 6 months, 1 year, or even longer.

a Cut curd with long curd knife in straight lines, approximately ½" (1.3 cm) wide.

b Cut curds in opposite direction yielding ½" (1.3 cm) cubes.

c Gently stir Cheddar curds with ladle until they shrink in size.

d Curds will have a fibrous appearance after stirring. Salt and eat as curds or place in cheese mold for pressing.

e Place cheese mold under press.

f Add weights to provide adequate pressure.

TO CLOTH BIND THE CHEESE

Cloth binding is a traditional sealing method for Cheddars. It prevents the cheese from drying out but still allows microflora to develop on the surface. This imparts earthy flavors to the cheese.

1 Cut 4 pieces of cheesecloth in a rough circle of such size that when laid over the top of the cheese they drape just to the bottom of the cheese. Coat the cheese with a layer of vegetable shortening (or lard if you are so inclined) **(A)**.

2 Lay a piece of cloth over the top of the cheese and use the shortening like a paste to get it to adhere to the cheese **(B)**.

3 Coat the cloth with more shortening so it creates a moisture barrier.

4 Turn the cheese over and repeat the process, allowing the second layer to overlap on the sides of the cheese **(C)**.

5 Turn and repeat twice more, using all 4 sheets.

Mold still needs to be kept in check when cloth binding a cheese. Scrub mold that appears with white vinegar mixed with salt. Smear the area with more shortening or fat when finished to ensure there is still a good moisture seal.

a Prep Cheddar wheel by rubbing surface with shortening or lard.

b Place first cloth over wheel and rub more shortening or lard over cloth to secure it to the surface.

c Add second layer of cloth and rub more shortening or lard on exterior to attach to layer of cloth below.

Comté, with its firm yet creamy paste and small eyes, is one of France's greatest culinary traditions.

CHAPTER 8:
ALPINE-STYLE CHEESE

Named for the mountains where they originated, alpine, or mountain, cheeses are some of the most majestic in the global cheese canon. The evolution of these cheeses can be traced back to the collective needs of those farming in the valleys of the massive mountain ranges in Switzerland and France.

In the winter the valleys were blanketed with snow and farmers needed to reserve, dry, and store enough forage from summer months to sustain their animals. If warm weather feed had to be saved for winter, what was a farmer to feed his animals during the summer? Farmers began to take their animals up into the mountains where there was ample pasture, leaving forage growing in the valley to be harvested and fed to the herd later. Though effective for feed demands, this migration meant that the men were away from their farms for months at a time and there was the challenge of how to utilize milk produced by the animals that were eating a wonderfully diverse diet of wild alpine grasses.

Farmers banded together, nominating one or two men to take all the herds in the village into the mountains. Cheese was the only realistic way to preserve the milk produced, so they built small cheese-making huts at various altitudes allowing the shepherd to move upward as the snow melted. There was no way to keep milk cold, and the vats carried up could not hold two milkings, so the men made cheese twice a day following each milking. Larger format, lower moisture wheels were the natural choice to accommodate the volume of milk they had, allow for longer aging and fewer wheels to wipe down and turn, and survive transport down the mountain to the markets.

The combination of low acidity in the milk (it was used immediately after milking) and lack of temperature controls in the hut meant that aging cheeses could be exposed to warmer temperatures, which allowed a specific type of bacteria called *Propionibacterium shermanii* to prosper within some of the cheeses. These bacteria produce carbon dioxide, and the creation of gas in the paste makes evenly shaped holes also known as *eyes*.

EYES VERSUS FLAWS

Holes or pockmarks in the paste of a cheese are considered eyes when their shape is uniformly round, smooth, and generally of a similar size. Uneven or gaping holes and cracks are considered flaws. In the early stages of aging, the growth of an unwanted bacteria called coliforms can lead to pinholes throughout the paste or a spongy texture. These bacteria are not necessarily harmful, though *E. coli* is part of the coliform group, but they are an indicator that pathogenic organisms may be present.

Large, uneven pockets of air—sometimes forceful enough to make the cheeses "blow" or explode—are the result of the growth of *Clostridium tyrobutyricum*. These bacteria can develop because of poor sanitation, a slow starter, using silage as feed, inadequate pressing, or overly warm curing temperatures.

Long cracks or fissures within the paste of a cheese are also undesirable. These can develop because there is too much proteolysis, leading to more brittle cheese that cannot respond to gas formation. Overpressing can create a similar result because it traps moisture and leads to secondary fermentation that creates gas and slits in the paste.

Pockets of air large enough to compromise the structure of a wheel of cheese are easily identified as flaws.

Philippe Goux (right) inspects wheels of Comté for a customer in the caves at the Fort Saint-Antoine. Photo: Daphne Zepos

PHILIPPE GOUX,
DIRECTOR OF SALES, MARCEL PETITE COMTÉ, JURA, FRANCE

The grand matchmaker, Philippe Goux is responsible for connecting nearly two hundred thousand wheels of Comté each year, at peak ripeness, with precisely the right customers. He oversees sales of Comté, arguably France's most treasured cheese, throughout France and around the world for revered affineur Marcel Petite. In partnership with the managers in their aging facilities, one being the famous former military fort at Saint-Antoine, Goux defined the quality profiles for each of Marcel Petite's three tranches of Comté.

YOU WORK WITH *FRUITIÈRES* (CREAMERIES) THAT PRODUCE CHEESE FOR YOU TO MATURE AND SELL. DO YOU CHANGE *FRUITIÈRES* OFTEN?

Fruitières are small dairies in villages in the Jura; Marcel Petite began with only two or three. Today, there are 160 *fruitières* [in the region] and Marcel Petite is working with thirty-one fruitières in the mountains and five in the plains area. In the mountains the flora is wilder and the *fruitières* are smaller, [giving us] better cheese.

We have strong relationships with the farmers, the cheesemakers, and the president of the cooperative. We never lose *fruitières*; last year we got a new *fruitière* because our business is increasing. Our contracts with the *fruitières* are for two years.

WHAT DO YOU LOOK FOR IN A *FRUITIÈRE*?

We choose a spirit, not the quality of the cheese, at the beginning. We often find *fruitières* with bad quality and look for a [willingness] to improve the quality. To do this can take ten years in a *fruitière* because there are many details and to improve each detail [takes a] very, very, very long time.

We have to find people—farmers, cheesemakers, cooperative presidents—[who will] be involved and willing to improve quality. In Comté the average ripening time is one year; it's difficult to improve quality when the maturation is for a year. Our main focus with the farmer is to explain to them what quality is, what they have to do to make good-quality milk. Like our customers, they must trust us to improve the quality, to improve the relationship.

WHY IS SILAGE FORBIDDEN IN THE FEED OF COWS CONTRIBUTING MILK TO *FRUITIÈRES*?

Silage is made with cultivated grass, from corn or cultivated grass, and in our area it's impossible to grow this kind of [crop]. Also, in silage you can find *butyric*, a bacteria that can destroy the cheese during the affinage, [another reason] why we don't feed silage to the cows.

When you feed corn, not wild grass, the flavor of the milk, the richness of the taste is not the same because those kinds of plants are too simple. In our area we have wild pasture—aromatic grasses are very important in Comté—where you can find more than one hundred kinds of grass and in that, we have a special taste, an experience.

IS IT REQUIRED THAT *FRUITIÈRES* USE SOME OF THE PREVIOUS DAY'S WHEY INSTEAD OF A COMMERCIAL STARTER?

No. We have a few cheesemakers who are working the traditional way, using the whey of the day before, but it's only 10 to 15 percent of our *fruitières*. The others are working from commercial starters but made in the area, from the wild flora of the area, and authorized by the Comté association.

WHAT TEMPERATURE DOES CURD HAVE TO HIT DURING CHEESE MAKING FOR A CHEESE TO BE CALLED "COOKED"?

The temperature must be over 48°C (118.4°F).

HOW DOES THE CHEESEMAKER KNOW WHEN THE CURD IS FINISHED COOKING IN COMTÉ?

It's a bit complicated because each cheesemaker has his own method. The cheesemaker modifies his make according to his own style and the changes in the milk—according to the weather, and lots of things. What is very special in Comté—for each day, for each vat—in a little *fruitière*, the cheesemaker takes care of each vat and sees the milk, the curd, touches the curd, and adapts the make with all these small details.

This is not an industrial method, and the aim is not to make the same Comté in the same vat; the aim is to make the best result with the milk from that day. After, the cheesemaker and the affineur adapt their work to get the best of the milk.

It's like wine: the winemaker adapts his work according to the harvest. You have to understand that if all the Comté were the same, I would resign because it would be too boring. Our work is to get the best of each cheese, of each Comté, and to know how to sell the differences. We have many customers and we ripen about two hundred thousand wheels each year, and for each wheel, we have to find the right customer. We taste each and every wheel before sending.

WHAT IS THE PURPOSE EXACTLY OF THE PRESSING IN COMTÉ PRODUCTION?

The main aim in pressing the Comté is to "put away" [get rid of] the whey and create the right structure for the paste. If we don't have good pressure in the making of the Comte it's impossible to get a good cheese—not because of the rind but the structure of the paste.

The quality of Comté depends on the story of Comté, and in the region it is in our veins.

PEOPLE ARE FASCINATED BY THE ASSESSMENT AND SELECTION PROCESS WITH COMTÉ. WHEN DO YOU BEGIN TO TASTE WHEELS AND WHAT DO YOU LOOK FOR?

Wine is my second passion and wine and cheese are similar because to [evaluate] we taste the cheese when the cheese is young—between four and eight months—like one does with wine. We try to find little signs [that] prove to us that we can continue ripening this cheese. Like in wine, we make mistakes (laughs), but it's exactly the process.

We have a great product in Comté and our goal during [the past] twenty years is to ripen—to elevate the cheese—and then to sell and explain the cheese like wine; we do a lot of tastings. We have a great product like a grand cru.

WHEN YOU EVALUATE THE COMTÉ ARE YOU LOOKING FOR SPECIFIC FLAVORS OR AROMAS THAT INDICATE TO YOU THAT A CHEESE WILL DO WELL OR WILL BE A PROBLEM?

When we taste, the aim is not to find a specific aroma—it is to find the potential of the Comté. It's more of an impression than a specific aroma. What we are looking for when we taste the cheese is to keep or not to keep the batch—it's more an impression, it's more a feeling. It's difficult to explain . . . and it's easier in the cellar with a plug.

HOW LONG DID IT TAKE YOU TO FEEL CONFIDENT THAT YOU COULD IDENTIFY THAT IMPRESSION OR FEELING?

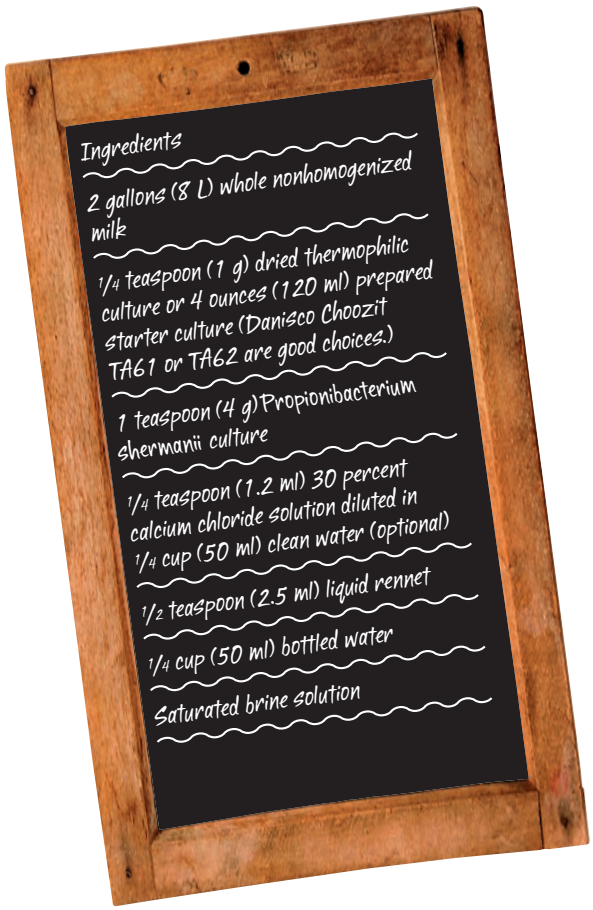
To sell cheese, it takes between three and five years, to [understand] the spirit of the cheese it takes ten years, and to do my job, running the sales department and working with people in the cellar, it takes ten to fifteen years. Each day we learn about the cheese because the cheese is changing every day, every month, every year. To sell the cheese, to know the cheese, to understand the cheese, and to understand the market in France, in the United States, in all the countries, it's complicated. Because we don't ripen or make a cheese for each market but we have to understand each market to sell them the right cheese.

WHEN YOU SAY "THE SPIRIT" WHAT DO YOU MEAN EXACTLY?

It's impossible to explain—the feeling of the product, the market, and of the environment. Knowing the market is very important because in our environment, the food environment, if you don't follow economics you don't understand the export—the currency and the politics and the economy. It's a very [comprehensive] work, that's the spirit. If a seller only knows his product, it's a pity, because we pass a message with our cheese, and to do that well we have to know the market and our customer.

DOES MAKING CHEESE WITHIN THE STRICT AOC GUIDELINES MAKE INDIVIDUALS BETTER CHEESEMAKERS, OR DOES IT RESTRICT THEM?

Comté has a long story and history, and the links between the people in the chain are very strong. To get a good product like Comté with a story and history—and we have very strict rules in the Comté association, in the AOC—depends on the links between all the people in the chain. The quality of Comté depends on the story of Comté, and in the region it is in our veins. To build the chain takes a long time, and it's impossible to have a very exceptional product like a great Beaufort, Gruyère Suisse or Etivaz because it is an area, it is rules, but it is also building the relationships between all the people working in this chain.



The diameter of the eyes in a wheel of Emmental will be proportionate to the size of the wheel.

EMMENTAL

The cheese that Americans call "Swiss" is based on this classic alpine style known as Emmental. *Propionibacterium shermanii* cultures generate carbon dioxide during aging, creating the eyes for which the cheese is known. These cultures also produce propionic acid, which gives the cheese its characteristic flavor and bite on the finish.

The cooking process brings the temperature of the curd up to 120°F (49°C). This process creates a smooth, elastic paste that is able to stretch and expand as the secondary culture produces gas during aging. The cheese is aged in three stages, first at 45°F (7°C) to let a rind begin to form on the cheese, then at room temperature for a few weeks to encourage gas production, and then finally back to 45°F (7°C) to finish its maturation. The cheese will begin to bulge during the warm maturation phase as it expands. Commercial large wheels of cheese have been known to explode from too much gas production!

Traditionally wheels of Emmental are more than 200 pounds (90.7 kg) and will have eyes between ½" (1.3 cm) and 1" (2.5 cm) in diameter. The recipe that follows will make approximately a 2-pound (905 g) cheese with eyes closer to ⅛" (3 mm) in diameter. This recipe benefits from doubling or tripling to produce larger cheeses with potentially larger eyes.

PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Using two pots to create a water bath, heat the milk to 90°F (32°C). While the milk is heating, dissolve the cultures in ½ cup (100 ml) of milk.

3 Add the dissolved cultures to the milk. Mix well. Maintain the temperature at 90°F (32°C) and ripen the milk for 10 minutes.

4 If using, mix the calcium chloride with ¼ cup (50 ml) of clean water and add it to the milk. Mix well.

5 Dilute the rennet in ¼ cup (50 ml) of bottled water, and immediately add it to the ripened milk. Stir for 1 to 2 minutes. Allow the milk to coagulate for 40 minutes.

6 Check the milk for a clean break. If the milk is not yet firm enough, wait 10 minutes and check again. Once a clean break is achieved, cut the curds into ¼" (6 mm) cubes, then allow the curds to rest for 5 minutes.

7 Maintaining a temperature of 90°F (32°C), stir the curds with a balloon whisk for 40 minutes. Break up any curds larger than ¼" (6 mm).

8 Slowly warm the curds to 120°F (49°C) over 35 minutes, stirring gently and continuously. The curds should shrink to the size of peas or beans **(A)**.

9 Hold the temperature at 120°F (49°C) for 30 minutes, continuing to stir. When ready, the curds should be very small and will bind together in a ball in your hand when squeezed **(B)**.

10 Allow the curds to settle, and then pour off as much whey as possible. Line a 2-pound (1 kg) cheese mold with cheesecloth and then ladle or pour the curds into the mold. Wrap the remainder of the cheesecloth over the top of the curds.

11 Press the cheese at 0.8 psi (5.5 kPa) (10 pounds [4.5 kg] of weight for a 4" [10 cm] round mold) for 30 minutes. See page 72 for pressing weights of other mold sizes.

12 Unwrap, flip cheese, rewrap, and press at 1.2 psi (8.2 kPa) (15 pounds [6.8 kg] of weight for a 4" [10 cm] round mold) for 2 hours.

13 Unwrap, flip cheese, rewrap and press at 1.2 psi (8.2 kPa) (15 pounds [6.8 kg] of weight for a 4" [10 cm] round mold) for 12 hours.

14 Brine the cheese in a saturated brine solution for 12 hours (6 hours per pound).

15 Allow the cheese to dry for 1 to 2 days, until the surface is dry to the touch.

16 Age for 1 week at 45°F (7°C), 80 to 85 percent relative humidity. Turn the cheese once a day, wiping with a cloth dipped in a brine solution each time.

17 Move the cheese to room temperature (68°F to 74°F, or 20°C to 23°C) and allow it to age for 2 to 4 weeks. Keep the cheese in a closed container to maintain 85 to 90 percent relative humidity. Wipe the cheese with a brine-soaked cloth once a day, and wipe off any mold that develops. During this time the cheese should expand as carbon dioxide is produced inside the cheese and eyes are formed **(C)**.

18 Return the cheese to a cool 45°F (7°C) 80 to 85 percent relative humidity environment. Continue to age for 4 to 12 months. Check the cheese once a week for excessive drying or mold growth. Wipe with a brine-soaked cloth as needed.

a Continue stirring until curds have shrunk.

b Squeeze curds to see if they hold together before allowing to settle

c Watch for expansion of wheel through sides, taking on a barrel shape.

GRUYÈRE

By removing the warm maturation phase, reducing or eliminating the *Propionibacterium shermanii* culture, and increasing the pressing weight, we can turn the Emmental make procedure into one for Gruyère. This cheese will sometimes have small eyes but nowhere near the number and size found in Emmental. It also tends to have a sweeter, nutty flavor.

The choice of whether to eliminate the *P. shermanii* culture altogether is up to the cheesemaker. Even some of the most dedicated cheese aficionados dislike the flavor generated by the culture, and if you or one of your potential consumers falls in this category, then you should of course leave it out.

Traditional Gruyère has its surface washed during aging to encourage growth of surface bacteria. Older cheeses are washed first, then the same washing liquid is used on the young ones. This transfers desirable surface bacteria from the old cheeses to the new ones. At home we can emulate this process by placing a bit of rind from a commercial Gruyère or Comté in the brine used to wash the cheese during aging (as an aside, Comté is a fine version of Gruyère, much like cognac is a fine version of brandy). For food safety, obtain the rind you use from a respected cheesemonger and use a saturated brine solution (which should be stored in a refrigerator) to reduce chances of transferring pathogenic organisms.

A wedge of gruyere is a satisfying snack on its own and also a versatile cheese in the kitchen for everything from fondue to quiche Lorraine.

PROCEDURE

1–10 Follow the same steps as the Emmental method, optionally adding only a ¼ teaspoon (1 g) of the *P. shermanii* culture in steps 2 and 3.

11 Press the cheese at 0.8 psi (5.5 kPa) (10 pounds [4.5 kg] of weight for a 4" [10 cm] round mold) for 30 minutes.

12 Unwrap, flip cheese, rewrap, and press at 1.2 psi (8.2 kPa) (15 pounds [6.8 kg] of weight for a 4" [10 cm] round mold) for 30 minutes.

13 Unwrap, flip cheese, rewrap, and press at 3.2 psi (22 kPa) (40 pounds [18.1 g] of weight for a 4" [10 cm] round mold) for 6 hours.

14 Unwrap, flip cheese, rewrap, and press at 6.4 psi (44 kPa) (80 pounds [36.3 kg] of weight for a 4" [10 cm] round mold) for 12 hours.

15 Brine the cheese in a saturated brine solution for 12 hours (6 hours per pound).

16 Allow the cheese to dry for 1 to 2 days, until the surface is dry to the touch.

17 Move the cheese to an aging environment of 55°F (13°C), 85 percent relative humidity. Turn the cheese every other day for 2 weeks, wiping with a cloth dipped in a brine solution each time. After a natural rind begins to form, turn the cheese and wipe with brine twice a week. After a month of aging, check on the cheese once a week and wipe with brine if surface growth is out of control. Age for at least 6 months total; 8 months is better. You can age this cheese as long as you would like. Once the cheese is cut, wrap in plastic or cheese wrap and move it to a refrigerator.

Grated Grana is a wonderful ingredient in your arsenal, adding a hint of umami to any dish it touches.

CHAPTER 9: GRANA-STYLE CHEESE

Aged hard cheeses are to the world of cheese what a reduction is to the world of sauces—dense with flavor and the potential to be savored in small doses. The most familiar cheeses in this group, Parmigiano Reggiano, Grana Padano, and Pecorino Romano, all come from Italy, where they have been enjoyed for centuries as standalone cheeses and incorporated into a plethora of traditional dishes.

The texture and intense flavor of these cheeses are achieved through a number of processes such as cutting the curds into small granules and heating them to encourage them to release moisture. Lower moisture means greater concentration of flavor-carrying solids such as fats and proteins.

When aging hard cheeses, it is essential to keep the rind well moisturized (but not wet) to prevent cracking.

Giorgio Cravero surrounded by wheels of carefully selected Parmigiano Reggiano in his family's aging rooms Photo: Alberto Peroli

GIORGIO CRAVERO,
OWNER, G. CRAVERO, BRA, ITALY

Quite possibly the most passionate man in Italy, Giorgio Cravero is the fifth generation in his family to select and mature Parmigiano Reggiano—one of the most recognized cheeses around the world—and Grana Padano. Decades of partnership and commitment to the best traditional practices have made the Cravero name synonymous with the highest standards of quality.

DO YOU THINK THE PARMIGIANO REGGIANO REGULATIONS MAKE CHEESEMAKERS FEEL CONFINED?

The cheesemakers are stimulated and they are creative when they have good milk to work with. They don't feel pressured because it's an everyday job for them, and it's easy to make that cheese every day from the day you decide that that is the project of your life. They make cheese 365 days a year—Sunday, Christmas, Easter—it's a hard job.

Small dairies that make six to ten wheels of Parmigiano Reggiano a day have one cheesemaker, and the huge dairies that make one hundred wheels of cheese a day have five to seven cheesemakers—all with different knowledge, capabilities, and secrets. For this reason, the challenge is to try to be consistent. In a dairy that makes one hundred wheels a day, consistency is something tricky . . . rare. This is the challenge.

YOUR FAMILY HAS BEEN WORKING WITH PARMIGIANO REGGIANO FOR OVER 150 YEARS, AND IN THAT TIME YOU'VE HAD TO CHANGE DAIRIES. HOW DO YOU SELECT NEW DAIRIES?

There are 390 producers, and we are working with just four of them; one is a farmstead and three of them are cooperatives. We've worked with one for twenty-five years, another one since 1988 (twenty-three years), and another for about a decade. In 2010 we added a fourth, and to be able to sign the contract with them for the 2010 production, I spent three years flirting. They are neighbors of one of the dairies we've worked with for twenty-five years, so we knew each other a long time and they used to sell their production to another company.

Before I was able to sign this new dairy—whose cheeses will be, in the next year, the best cheese we have probably ever matured in my family; it's absolutely an emerald, a masterpiece—I was trying to find another one for a few years.

WHEN YOU LOOK FOR A NEW DAIRY, DO YOU WATCH THEM FOR A NUMBER OF YEARS TO SEE IF THEY ARE CONSISTENT YEAR TO YEAR?

Exactly, and you also have to manage the situation because every one of the 390 dairies has customers, and so to kick out the previous customer is hard and could be dramatic. I trust the dairies I work with, but in the past some competitors have visited our dairies, thinking about switching.

Before I was able to sign this new dairy—whose cheeses will be, in the next year, the best cheese we have probably ever matured in my family; it's absolutely an emerald, a masterpiece—I was trying to find another one for a few years.

THE PARMIGIANO REGGIANO CONSORZIO EVALUATES ALL WHEELS PRODUCED. ARE THESE INSPECTIONS NERVE-RACKING?

This happens before the maturing company like ours selects the wheels. The Consorzio checks the cheeses three times a year when the cheeses are around twelve months old—in the springtime, summertime, and the fall. They check the young cheese where the cheeses are maturing—so they could be in the dairies' warehouses or in general warehouses that mature for different companies and dairies.

To check means they tap, they hammer the wheels to try to understand if inside the cheese there are holes or cracks—mistakes or defects—and they check the rind. The day that they tap the wheels they are also allowed to cut some wheels to taste the flavor. If the Consorzio decides that a singular wheel has cracks or problems, they put the cheese in a machine that marks it to indicate a difference in quality. For second-tier [wheels] the machine brands parallel lines on the rind. For the third tier—cheeses that have big mistakes—there are machines that cancel the little dots on the rind of Parmigiano Reggiano. Those cheeses are not sold under the name Parmigiano Reggiano.

DO ANY OF THE DAIRIES EVER DISAGREE AND APPEAL THE CONSORZIO'S DECISION?

Absolutely there are a lot, a lot, a lot, a lot of discussions because the price of the second tier is 30 percent cheaper and the price of the third tier is 60 percent cheaper, and so the dairies are always arguing with the Consorzio. Definitely.

AT WHAT AGE DO YOU SELECT WHEELS?

Immediately after this because the second- and third-tier wheels are not cheeses that the dairies want to sell us; they sell them via another avenue.

PARMIGIANO IS SO HARD; CAN YOU TASTE THE WHEELS WITHOUT CUTTING THEM?

We don't taste the cheeses during selection—our assessment is based on confidence and familiarity—we select wheels by tapping them. During the selection if we find 20 percent of the cheeses with troubles in tapping them, we can ask the producer if we can open a wheel to try to discover the problem.

IS IT TRUE THAT PARMIGIANO REGGIANO PRODUCERS CANNOT USE COMMERCIAL STARTERS?

Yes; they use the whey from the previous day.

ARE THERE EVER CONCERNS ABOUT CONTAMINATION?

No. It is safe. In twenty-five years I've never heard about troubles with bacteria, bad bacteria like *Listeria*—something like that in our work. Never. I'm confident that it's safe.

MANY FOOD SCIENTISTS SAY THAT THIS IS THE SAFEST CHEESE BECAUSE IT IS LOW-MOISTURE; WITH SUCH LOW MOISTURE, HOW IS THERE ENOUGH MICROBIAL ACTIVITY TO MAKE SUCH INTENSE FLAVOR?

I called one of my cheesemakers and we arrived together to this kind of answer … [First] I want to tell you my answer; I am always trying to explain this to customers. When Parmigiano Reggiano is really good, when it could be considered the best cheese in the world—it is something connected with the land, the *terroir*. In the production area there are some territories where—I don't want to tell you a poem, but—it is God. God decided that the forage, the grass, of that particular territory allows the production of a kind of milk that allows the production of a kind of Parmigiano Reggiano. It's not just about something connected with the technique or the rules of making the cheese—it's the natural gift of the land that makes the production of some great products because in the 390 dairies there are differences in quality. The differences in quality are huge! On the outside Parmigiano Reggiano wheels all seem the same. When people taste Parmigiano Reggiano, because it's often really good, they think that it's always good, but this is not true; the differences in quality can be enormous.

That is my answer. The cheesemaker's answer—he talked about the milk enzymes, but this is connected to the previous answer, to the forage, because some grasses create some enzymes better than others.

WHY DO THEY ALLOW MILK FROM SILAGE-FED COWS FOR GRANA PADANO AND NOT PARMIGIANO REGGIANO?

Grana Padano is more industrialized; silage is allowed because in the making of Grana Padano they are allowed to use a preservative called *lisozima* [lysosme], a mega protein that prevents the bad fermentation that silage can create. Silage, and of course the preservative, is not allowed in Parmigiano Reggiano making. The dairies in Grana Padano are bigger and the cheese is made in a more industrialized way. Particularly with the small dairies we work with—some make only six wheels a day—[Parmigiano is] a similar item but a completely different product. It's different food.

PARMIGIANO REGGIANO MUST BE MADE WITH RAW MILK, BUT THE CURDS ARE COOKED AT A HIGH TEMPERATURE. DOES THIS MIMIC PASTEURIZATION?

No, pasteurization is at 78°C [172°F], and the curd of Parmigiano Reggiano is cooked at 54°C to 55°C [129°F to 131°F].

WHAT HAPPENS AFTER THE CURDS ARE COOKED?

After the cooking at 54°C to 55°C (129°F to 131°F), the whey and the curd are together. At the right moment they separate. The curd, little grains, drops to the bottom of the cauldron and in an hour the weight of the whey helps the curds form into a big ball at the bottom of the cauldron. The big ball of cheese is cut in two to make two wheels of cheese. Every cauldron makes two wheels. In slang they are called twins [*gemelli*]. They take the big ball, then they use cloth to drain it, and they keep whey for the next morning.

I'VE READ THAT DURING AGING THE AFFINEUR WANTS FAT TO SEEP OUT OF THE CHEESE. IS THIS TRUE?

The fat does not escape from the cheese in an important way—the percent is minimal, ridiculous—and in my opinion the fatness of the texture is an absolutely crucial characteristic even if the cheese is twenty-four or thirty months old; it must be moist. I don't like the Parmigiano Reggiano very dry and hard; we describe ourselves as soft and sweet.

DO YOU PREFER PARMIGIANO REGGIANO FROM ANY SPECIFIC SEASON?

A very important and truly crucial characteristic we are looking for in the cheeses we are selecting and maturing is consistency. The dairies we work with mostly feed the cows hay twelve months a year. They dry the fresh grass in the summer because they think that the health of the animals is more consistent—they feel better all the time—and at the end of the day it means that the cheese made in January, April, August, or November are pretty much the same. And this is something that I look for in a producer; I know that it cancels the romanticism of the seasonality, but in my opinion, if the cheese is as good in August as at Christmastime, that is a good thing.

Grana is worth the effort because it is just as good enjoyed on a cheese board as an ingredient shaved over your favorite pasta or salad.

GRANA

This cheese probably takes the most patience of any homemade cheese, since the time and ingredients you invest won't reap any rewards until nearly a year has past. However, the recipe is fairly simple, so it is easy to make on a free weekend. Make it a tradition to make it during the holidays, to be enjoyed during the holidays the following year!

Partially skimmed (2%) milk is used to make Grana cheese. The curd is cut finely and cooked to a high temperature, both of which compel a great deal of whey to be expelled. The result is very low-moisture cheese and a very low yield for the amount of milk used. Expect a single pound (½ kg) of cheese for every 2 gallons (8 L) of milk. The reduced fat prevents the cheese from becoming rancid and the low moisture hinders growth of bacteria, making it ideal for the long aging process.

PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Using two pots to create a water bath, heat milk to 94°F (34°C).

3 Add the culture to the milk. If using lipase, add it as well. Mix well. Maintain the temperature at 94°F (34°C) and ripen the milk for l45 minutes.

4 Add the calcium chloride, if using. Dilute the rennet in the bottled water, and add to milk, stirring constantly for 1 to 2 minutes. Stop stirring and allow the milk to coagulate for 45 minutes, or until a clean break is achieved.

5 Cut the curds using a large balloon whisk until the curds are about the size of peas. Allow the curds to rest for 10 minutes **(A)**.

6 Begin heating the curds slowly until they reach 124°F (51°C). This should take about 45 minutes. Stir the curds with a whisk until they reach 105°F (40°C), after which you can allow the curds to settle and mat.

7 Drain the curds into a colander lined with cheesecloth. Then transfer the curds into the cheese mold lined with cheesecloth. Fold the cheesecloth over the top of the cheese and put the mold in a cheese press.

8 Press the cheese at 0.8 psi (5.5 kPa) (10 pounds [4.5 kg] of weight for a 4" [10 cm] round mold) for 30 minutes. See page 72 for pressing weights of other mold sizes.

9 Remove cheese from the mold, unwrap, flip, rewrap, then press at 1.6 psi (11 kPa) (20 pounds [9 kg] of weight for a 4" [10 cm] round mold) for 1 hour.

10 Turn cheese again, and press 1.6 psi (11 kPa) (20 pounds [9 kg] of weight for a 4" [10 cm] round mold) for 12 hours.

11 Remove cheese from press and soak in a saturated brine solution for 12 hours.

12 Age for 9 to 12 months (or even longer) at 55°F (13°C) and 80 percent relative humidity.

a Cut through the curds with a whisk and continue until they are pea-size.

These cheeses share the unique distinction of being one of the only foods that have visible green and blue molds growing on them and are enthusiastically consumed by the masses.

CHAPTER 10: BLUE CHEESE

These cheeses share the unique distinction of being one of the only foods that have visible green and blue molds growing on them and are enthusiastically consumed by the masses. Veins of blue and green develop because of molds that are added to the milk in the early stages of cheese making.

The technique employed to get these molds to develop is called piercing, and it is vital to the development of the molds because they are aerobic and require oxygen in order to grow. This task is an important one because the strain or combination of strains of blue mold, the timing, and amount of piercing will all have a considerable impact on the final cheese texture and flavor development.

A perfect bite of blue cheese and fresh fig

It bothered Randolph that the King of English cheeses was extinct in its traditional form.

JOE SCHNEIDER,
DIRECTOR AND CHEESEMAKER, STICHELTON DAIRY, MANSFIELD, ENGLAND

The Yank who spent years as a roving cheesemaker honing his skills and had the grapes to take on the holy grail of all things English: Stilton. Joe Schneider was recruited in 2004 by Randolph Hodgson, founder of Neal's Yard Dairy and advocate of traditional farmhouse cheeses of the British Isles, to make the Stilton of years past using unpasteurized milk. The resulting cheese called *Stichelton* [cheeses bearing the Stilton moniker must be made with pasteurized milk per rules of the Stilton Cheesemakers' Association] in its short existence has fueled controversy and pleased both nostalgic and pragmatic palates.

STILTON HAS A UNIQUE PROCESS, FROM OTHER BLUE CHEESES. HOW DID IT EVOLVE?

Usually you can fit cheese into one of two camps: a rennet camp or a lactic camp. Rennet cheeses use lots of rennet and have a quick set, and then your lactic cheeses—like your goat cheese—are set maybe with a tiny bit of rennet but mainly through development of the acidity overnight. One recipe is quite short from milk to curd and the other one is like twenty-four hours. Stilton is kind of schizophrenic; it straddles both worlds.

I think the reason is that traditionally cheese making was the domain of the farmer's wife; he milked the cows, she brought the milk in and had to do something with it, but she was busy—baking bread, raising children, feeding cows—so cheese making couldn't monopolize her day. She had to have a cheese recipe that allowed her to stretch the make out; put the starter in, then go away and do all those other things, then come back and put the rennet in and go away for a few hours, and then come back. It's a recipe that was wrapped around the rhythms of her day.

When the blokes got involved and put other blokes in factories and started paying them, this kind of recipe no longer fit. You need to shorten it because it's expensive, so you look for ways to shorten that recipe, and I'm sure that happened to all the territorial traditional cheeses in Britain over the centuries. Recipes are produced in a shorter amount of time in a more efficient way, totally changing the recipe. And once you do that, the salesmen show up and start selling you different coagulants and starters that go faster to help you achieve that aim. I think that Stilton avoided that migration simply because attempts to change it didn't produce the thing that was recognizable as Stilton.

Cheesemaker Joe Schneider (left) stands with Randolph Hodgson of Neal's Yard Dairy in front of the dairy where they created Stichelton.

WHAT MOTIVATED YOU TO WANT TO RETURN TO WHAT YOU WOULD CALL A MORE TRADITIONAL VERSION OF STILTON?

The idea was Randolph's. He has devoted thirty years of his life to championing British farmhouse cheeses and all are made in the raw milk version—that's what real cheese making is from his point of view. He was selling raw milk Stilton up until 1988 when it disappeared. The cheeses that came in to replace it, in his mind, never achieved the same pinnacle of flavor. It bothered him that the King of English cheeses was extinct in its traditional form. His motivation was to sell that fantastic Stilton to his customers. He asked a couple of the smaller producers to make a raw milk version for him and they wouldn't. So he grabbed me. For me the motivation was this was the holy grail of cheese making—to bring back raw milk Stilton, and by an American no less.

YOU CHANGED ONE OTHER THING. YOU USE A TRADITIONAL COAGULANT. WHY?

Most cheesemakers use vegetarian coagulant because it appeals to a broader market, but in my opinion it simply tries to mimic what natural rennet does, and it doesn't do it as well. So I've only ever made cheese—not only on this project but other projects—with traditional rennet, real animal rennet, because it makes the best cheese.

WHAT'S THE PURPOSE OF SMOOTHING THE RIND PRIOR TO PIERCING?

When the cheeses come out of the hoops they're very open in texture. They've got big cracks and holes in them, which is good—that's where the bluing is going to occur—but if I don't seal that rind up it will start going blue immediately. You need the cheese itself to mellow and mature and how much you do that is up to you and your recipe. So you have to rub that up to close out the air from the interior of the cheese—by scraping up the rind and then smoothing it like icing a cake, just plugging the holes and building a very nice rind that can dry out a little bit—and then it acts as a moisture barrier. It's got two roles. The main one is to keep the air out until you're ready for the cheese to go blue, and then you pierce it.

ARE YOU DELAYING THE BLUE MOLD DEVELOPMENT BECAUSE THEY WILL OUTCOMPETE OTHER BACTERIA?

No, it's that if they start growing right away, and breaking the cheese down, it will have too much moisture in it; the postacidification hasn't finished yet, so the bluing could be disruptive because you've got pockets of acidity and wetness that hasn't come out. Basically you don't want the blue to go to work until the substrate is right because it will go right away and you'll have a big sloppy mess in six weeks instead of a good firm cheese.

STICHELTON HAS A TWENTY-FOUR-HOUR CHEESE-MAKING PROCESS. WHAT ARE THE CRITICAL CHECKPOINTS ON THAT LONG CONTINUUM?

Initial conditions are extremely important. The analogy I like to use is that ridiculous sport, the only one that the Brits are actually good at in the Winter Olympics, called curling. You throw a stone across the ice and it coasts down to the other end, one hundred feet away and it's supposed to land in the bull's-eye; Stilton making is very much like that. Initial conditions when you let the stone go, way back—one hundred feet back—have huge implications about where the stone lands. And once it's going, you really can't do anything except shake your little broom. In Cheddar making you've got lots of ways to intervene in a short space of time to shepherd that recipe how you want it to go, but for Stilton you've got to set it up right so that when you let go of the stone—when I go home in half an hour—it's coasting and it lands in the bull's-eye.

STICHELTON WHEELS DON'T COME OUT OF THE FORMS FOR DAYS. WHEN DOES AGING BEGIN?

That's a really interesting question because it's much harder to find that line of demarcation. When I made Cheddar we'd take it out of the press, bandage it, put a cloth on it, and put it into the maturing room—very easy to say that's the beginning of maturation. Stichelton is in the hoops for four or five days and that's one stage of maturation where it's very humid, very warm, it's developing yeast and different molds growing on it, and it's still draining. Then it gets rubbed up and goes into another room which is 12°C (53.5°F) with lots of airflow—we call it the drying room because I've got to dry those coats out a little bit. But then I've got to move it into another room when it's a certain age, different conditions, and then I've got to pierce it, twice actually with a week in between, so the idea of just putting a finished block of fat and protein on the shelf and saying, "All right, you mature now," doesn't really work with Stichelton because you've got so many other things to do [pierce it, turn it, and move it into different rooms].

WHY DO YOU PIERCE IT TWICE?

Because of the size of our cheese. Piercing is another one of those controls where every cheesemaker gets to decide what they want. We can decide how many needles go in, the diameter of those needles, how deep they go, when we do the first piercing [how old it is—that varies from three weeks to six weeks], and how many times you pierce it.

A luscious wedge of creamy, spreadable blue cheese

CREAMY BLUE

This version of blue cheese is high in moisture and does not crumble easily when cut with a knife.

Penicillium roqueforti is available as a powder from cheese-making suppliers. If you do not have access to *P. roqueforti* powder, you can use store-bought blue cheese to inoculate your milk. Purchase a well-veined blue cheese that is fairly fresh (purchase it from a cheesemonger who has good turnover). Follow the instructions that follow (step 4) to extract a sample of the blue that is as uncontaminated as possible. If you fail to get blue mold growth in your cheese, you may need to use a different cheese as a source.

Blue cheeses need a high-humidity environment for the blue mold to grow. We create this environment by sealing the cheese in a 1-gallon (4 L) sealable plastic bag, or a plastic food container. Blue mold needs oxygen to grow as well, so it is good to leave the bag open a couple of inches (5 cm) or to leave the container's lid cracked slightly. Try to keep the cheese out of contact with the bag or container as much as possible to allow for good airflow to the cheese's surface.

This recipe is based on one written by Mary Rosenblum.

Equipment

- 2-pound (1 kg) cheese mold with a follower
- Butter muslin cheesecloth
- 1-gallon (4 L) sealable plastic bag or a plastic aging container
- Piercing tool
- Tin foil for wrapping
- Cheese cave
- Pans, etc

Ingredients

- 2 gallons (8 L) whole nonhomogenized milk
- 1/4 teaspoon (1 g) dried mesophilic culture or 4 ounces (120 ml) prepared starter culture (MA4001 culture or similar)
- 1/4 teaspoon (1 g) mild to medium lipase
- 1/8 teaspoon (0.5 g) Penicillium roqueforti powder or a walnut-size scoop of a well-veined blue cheese
- 3/4 teaspoon (4 ml) 30 percent calcium chloride solution diluted in 1/4 cup (50 ml) clean water (optional)
- 1 teaspoon (5 ml) liquid rennet
- 1/2 cup (100 ml) bottled water
- 2 tablespoons (30 g) pickling salt plus extra for salting during aging

PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Using two pots to create a water bath, heat the milk to 90°F (32°C).

3 Add the starter culture and mix well. Add ¼ teaspoon (1 g) lipase and mix well.

4 If using *P. roqueforti* powder, sprinkle it on top of the milk, let it hydrate for 5 minutes, and then mix well.

If using cheese as a starter, remove ½ cup (100 ml) of warm milk from the pot and place in a small bowl. Unwrap the cheese then "face" it by cutting a thin slice from its side with a clean knife. Using a clean spoon, scoop out a walnut-sized section of the cheese that has good veining **(A)**. Avoid including any surface of the cheese that might have come in contact with someone's hands or the plastic wrap. Mix the cheese sample with the ½ cup (100 ml) of warm milk until it is dissolved, then add it to the rest of the milk **(B)**.

5 Allow the milk to ripen for 1 hour.

6 Add calcium chloride, if using. Dilute 1 teaspoon (5 ml) of rennet in ½ cup (100 ml) of bottled water. Add the rennet to the milk and mix for 1 minute. Allow the milk to coagulate for 45 minutes or until a clean break is achieved.

7 Cut the curd in ½" (1.3 cm) cubes. Wait 5 minutes, then stir every 5 to 10 minutes for 60 minutes. Maintain a temperature of 90°F (32°C) during this time.

8 Stop stirring and let the curds settle for 15 minutes. Pour off the whey and then drain the curds in a cheesecloth-lined colander. Return the curds to the pot.

9 Add 2 tablespoons (30 g) of pickling salt to the curds in three batches, stirring after each addition.

10 Line a 2-pound 1 kg) cheese mold with cheesecloth. Fill the mold with the curds. Cover the top of the mold with a follower and place the mold on a plate **(C)**. Place a pint-size jar filled with water on top of the follower. Turn the cheese every 15 minutes for 2 hours. Remove the jar and allow the cheese to drain overnight.

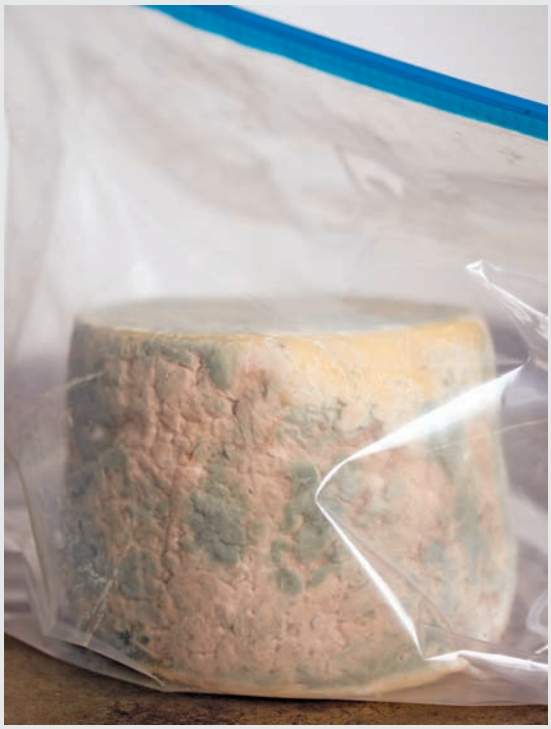
11 Remove the cheese from the mold. Sprinkle all sides of the cheese generously with pickling salt. Place the cheese on a plate and enclose it in a plastic container or in an inflated 1-gallon (4 L) sealable plastic bag **(D)**. Keep the cheese at room temperature in a dark place. Turn every 3 days, removing any collected liquid, and sprinkling with more salt.

12 After approximately a week, blue mold growth should appear. Poke small holes in the flat sides of the cheese 1/3" (8 mm) apart **(E)**. Use a thin knitting needle, an ice pick, a thermometer, or something similar. Continue to turn every 4 days until the mold is thick.

13 Move the cheese in its ripening container or bag to a cheese cave at 55°F (13°C). Age it for 3 months, turning it approximately every week.

14 Remove the cheese from the ripening container and wrap it tightly in plastic or foil. Return it to the cheese cave and continue to age 3 to 6 months more.

a Scoop out section of the cheese with plenty of blue mold.

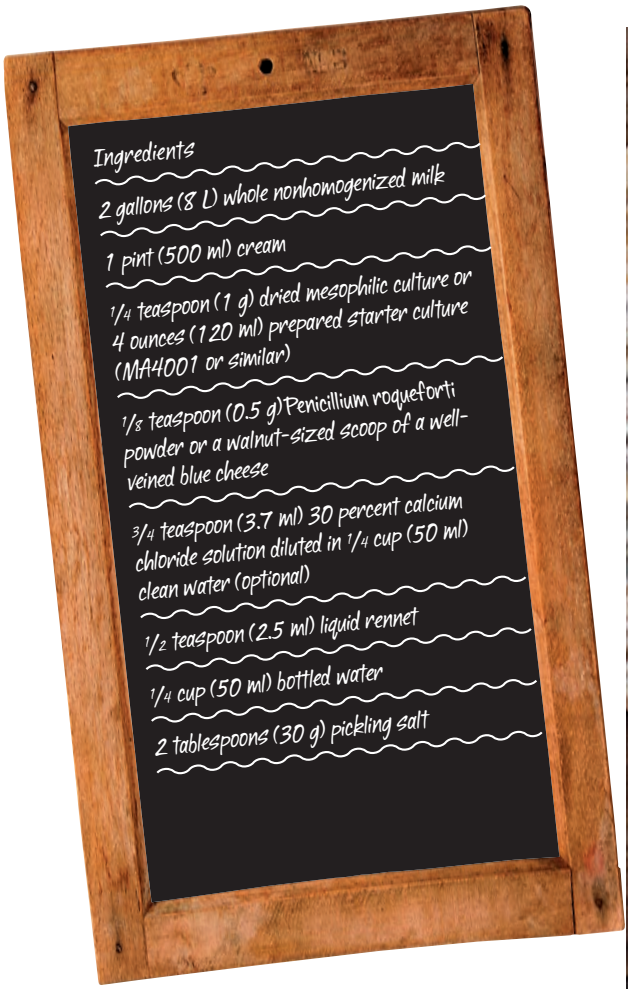


d Place cheese in plastic bag and seal, turning every few days and removing any released liquid.

b Mix blue cheese with reserved warm milk until smooth and add to ripening milk in pot.

c Place cheese mold on plate or in bowl to capture whey and set jar atop follower for gentle pressing.

e Pierce from top to bottom with sanitized tool before moving into cave.



Stilton-style blues will crumble, apart showing off their attractive dark blue veins.

MILLED CURD BLUE
(a.k.a. STILTON)

Sometimes referred to as the "King of the Blues," Stilton is a cheese known for its strong flavor and crumbly texture. Technically to be called Stilton, a cheese must be manufactured following strict guidelines in one of three English counties, but home cheesemakers often borrow its name to describe a cheese that mimics its style.

The make process has a lot in common with that of Cheddar production. The curd is allowed to acidify (in this case overnight), then milled (broken up into chunks), salted, and molded. Unlike Cheddar, Stilton is not pressed but instead allowed to compress under its own weight. This leaves small air pockets in the cheese in which the blue mold will find oxygen and grow. The sides of the cheese are smoothed by hand and then pierced to allow air into the cheese to further aid blue mold development. All of this is a very hands-on process, and if you love blue cheeses, it gives you a chance to be intimately involved in its creation.

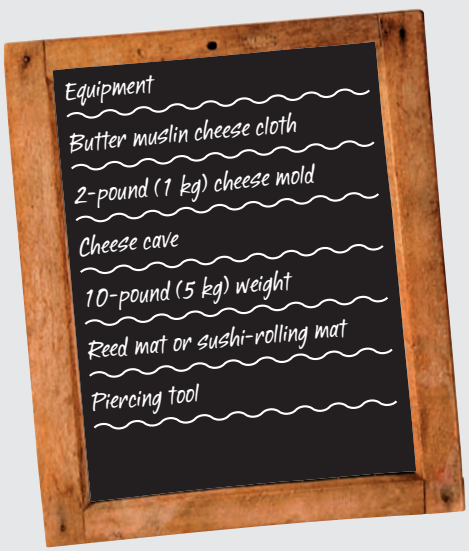
PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Using two pots to create a water bath, heat the milk and cream to 88°F (31°C).

3 Add 4 ounces (120 ml) of mesophilic starter culture or ¼ teaspoon (1 g) of DVI culture and mix well. Sprinkle *P. roqueforti* powder on top of milk, wait 5 minutes, then stir into the milk. Allow the milk to ripen for 30 minutes.

4 Add calcium chloride, if using. Dilute ½ teaspoon (2.5 ml) of rennet in ¼ cup (50 ml) of bottled water. Add the rennet to the milk and mix for 1 minute. Allow to coagulate for 60 minutes or until a clean break is achieved.



5 Take a large balloon whisk and use it to slice the curds **(A)**. Try to move the whisk through every section of the curd, while avoiding as much as possible slicing any section more than once. Allow the curds to rest for 30 minutes **(B)**.

6 Pour the curds into a cheese-cloth-lined colander. Once the whey has drained, tie the corners of the cheesecloth together to form a bag and hang it over a sink or pot. Allow it to drain for 15 minutes.

7 Move the bag to a cutting board or cooking sheet set up to drain into a sink. Place another board or cooking sheet on top and place 10 pounds (4.5 kg) of weight on top. Allow it to drain overnight **(C)**.

8 In the morning, break the solid mass of curd into walnut-size pieces with clean hands **(D)** and transfer them to a bowl. Add 2 tablespoons (30 g) of salt in two batches, mixing after each addition.

9 Place a reed mat on a draining surface, followed by a cheese mold **(E)**. Fill the mold with the salted curds. Flatten the top of the curds. Cover the mold with a reed mat and a small cutting board. Allow the curds to compress under their own weight. Carefully pick up the mold with the bottom mat and flip it over every 15 minutes for 2 hours.

10 Keep cheese in the mold for 4 days at room temperature. Flip the mold twice a day.

11 Remove the cheese from the mold and move to a cheese cave at 55°F (13°C) and 85 percent humidity. To help keep the cheese from drying out and encourage mold development, wrap it loosely in cheesecloth. The cheese should develop a thick coat of mold in 2 to 3 weeks, at which point it is time to smooth and pierce the cheese **(F)**.

12 Pour some boiling water into a small dish, place a small metal spoon in the dish, and wait for the water to cool until it is just warm (this will sanitize the bowl and spoon). Place the cheese on a clean surface. Smooth the surface by scraping it with the back of the edge of the spoon **(G)**. Dip the spoon in the warm water from time to time so that moisture from the spoon creates a thick paste on the surface of the cheese. Spread this paste into any crevices to create a smooth surface **(H)**.

13 Pierce the cheese from the side with a thin knitting needle, ice pick, or metal skewer **(I)**. Pierce starting ½" (1.3 cm) from the top of the cheese, and continue piercing every ½" (1.3 cm) until you are ½" (1.3 cm) from the bottom of the cheese. If the cheese starts to crack, stay farther away from the top or bottom or use a thinner object to pierce. Insert your piercing tool deep enough so that it reaches approximately the center of the cheese. Move over along the side by ½" (1.3 cm) and repeat. Continue until you have made your way around the cheese.

14 Return the cheese to the cave and continue to age at 55°F (13°C) and 85 percent humidity. Age at least 60 days, and preferably 3 to 4 months.

(Continued)

a Insert whisk at edge of pot, pressing down and pulling around edge of pot and back up.

b Appearance of curds after resting, ready to pour into cheesecloth for draining.

c Unwrap curds after overnight pressing and draining.

f Watch for development of surface molds as your cue that it's time for smoothing the rind.

g Dunking the spoon in hot water regularly, run back of spoon across surface to smooth molds and close up any crevices.

d Hand mill curds by breaking into walnut-sized pieces.

e After mixing with salt, place curds into cheese mold that is resting atop a ridged mat to allow draining.

h The smoothed rind will be ready for piercing.

i Drive piercing tool to midpoint of wheel at regular intervals.

CHAPTER 11: SURFACE-RIPENED CHEESE

All cheeses—save those that are dipped in wax or Plasticoat, or sealed in Cryovac—develop communities of microbes on their surface; these communities make up what we call the rind of the cheese. Surface-ripened cheeses are a unique category in which the microbes that flourish on the cheese's surface play an important role in the ripening of the cheese.

The development of these ripening microbes depends on the chemical composition of the cheese (acid, salt, mineral, and moisture contents), the techniques employed during cheese making, and the environmental conditions during aging. There are three major types of surface-ripened cheeses: *Geotrichum*, bloomy, and washed rind or smear-ripened.

Crottin curds will shrink considerably from the time they are first scooped (bottom) to later stages of the draining period (top).

GEOTRICHUM CHEESES

Geotrichum is a contributor in the development of a wide variety of cheeses, but in some it plays more of a leading rather than secondary role in forming the rind and also metabolizing lactic acid, releasing enzymes and thus being a catalyst in the breakdown of proteins and fats in the paste of the cheese. Once that consumption of lactic acid by the *Geotrichum* begins, the lactic acid content at the center of the cheese will be higher than in the paste directly beneath the rind. This imbalance prompts migration of lactic acid toward the rind to reestablish even distribution of lactic acid throughout the paste. The refreshed supply of lactic acid replenishes the food source for *Geotrichum* and allows for continued breakdown of the paste.

These cheeses are often made in small sizes and are somewhat delicate to make and age. *Geotrichum* requires a higher pH of 5 (lower acidity), some salt but not too much, lack of moisture, and specific temperature and humidity. There are multiple strains of *Geotrichum*. One technique that helps lower the acidity of the surface, to encourage *Geotrichum* development, is to mix ash with the salt that is applied after unmolding. When effectively developed, the surface of these cheeses will appear wrinkly and normally be some shade of white, possibly tending toward ivory.

Bloomy rinds, Geotrichum rinds, and washed rinds are all part of the family of surface-ripened cheeses.

Allison Hooper and Bob Reese, co-owners of Vermont Creamery, pose with kid goats against a backdrop of the Vermont lanscape in spring.

ALLISON HOOPER,
CO-FOUNDER AND CHEESEMAKER, VERMONT CREAMERY, WEBSTERVILLE, VERMONT, USA

Allison Hooper and Bob Reese, co-owners and business partners, have been pioneers not once but twice since they started Vermont Creamery in 1984. They introduced Americans to the pleasures of goat cheese and cultured dairy products, building a market as they went. Twenty years later they brought the delicate aged goat's milk cheeses that had drawn Allison to cheese making decades earlier into the American artisan cheese marketplace. The new product line has been well received, particularly the Bonne Bouche, an ash-dusted goat's milk disk with a crinkled rind, which took second place overall out of more than 1,400 cheeses in the American Cheese Society's annual judging and competition in 2010.

If I wanted to start my cheese business today, I would go into the marketplace and visit places and ask, "What sells? What's cool?"

Allison Hooper helps flip racks of the delicate Bonne Bouche, a choreographed effort that requires a team of two.

WHAT DREW YOU TO CHEESE MAKING?

It was by accident. In college I did my spring junior year abroad in Paris and one of my teachers suggested that I work on a farm. I heard from two places: One was a vegetable farm in the south of France, and one was the dairy in Brittany. I thought the dairy sounded cool and I went there.

My job consisted mostly of animal care—they kept me on a very short leash. I did milking, moving fences, moving animals, and a lot of haying and planting. They let me into the cheese house eventually. I found it interesting and fun and I liked the cheese. We were making all of the products that we make today—*crème fraîche* and *fromage blanc*.

DID THESE EXPERIENCES INFLUENCE YOUR FUTURE BUSINESS?

They totally influenced what we made because, first of all, it was the only thing I knew. I didn't have any formal training in cheese making—remember none of us did in those days in the United States. We didn't know what we were doing, and there wasn't any place to go to find out.

The products that we made in Brittany were the basis of our company because the fresh cheese was relatively easy to make. It was duplicable and we had to make something that was going to create cash.

YOU DID EVENTUALLY GO INTO THE CHEESE ROOM AND WERE YOU GOOD AT IT?

I had a natural aptitude for the aesthetic that they were looking for. I was able to distinguish a good cheese from a bad cheese. There were lots of things that you had to do to the cheese—"Am I going to put this under the fan today? Are they going to dry out? Do I need to wash them with salt? Do we need to brush them?"—there was a lot of judgment and thinking about the cause and effect of what you were doing, and some of that was not being afraid to try things or to go and ask.

Some of these things you just absorb by observing. I had a natural aptitude for going into the cheese room and saying, "Okay, I have cheeses to flip, I have milk I need to prepare, I have to dip off cheese, I have to unmold cheeses," and understanding what I should do first. You have to organize your day in a way so that you do things in a particular order that makes sense and at the end of the day you're preparing your market for the next day. Cheese making is all about timing and some level of control so that you do the same thing every day.

WHERE DID YOU LEARN TO MAKE THE SURFACE-RIPENED CHEESES?

I went and worked on a farm in Haute-Alpes where they had goats. It was a village that was kind of a community farm, so there were a number of families that were involved in the farm. We made Picodon.

The goats came in at night to be milked and in the morning, after milking, they would head down the street and go off into the mountains. We'd put the evening milk in this cistern in the center of town—a big "milk can." In the morning we would add the warm milk from the animals to the cold milk and that miraculously gave you just the right temperature for cheese making. We didn't add starter culture to the milk—it was raw milk—we used the whey from the day before. You took a cup of that whey, put your rennet in it and then added that to the milk. It coagulated overnight and you had cheese for the people in the town. From my point of view, having had no prior training in cheese technology or really any understanding of what was going on, it was the most simplified method of cheese making.

Bonne Bouche forms are filled with curds, flipped at regular intervals and allowed to drain

DID THAT PROCESS SEEM RISKY TO YOU THEN?

Not at all. I had absolutely no knowledge of the risk of what they were doing. There was another cheese-making facility on the farm, in the basement of this stone building that was built into the hill. Cheese making there was a matter of a few plastic tubs—pour the milk in, add the rennet, let it sit overnight. The next morning you ladled out the cheeses, they drained, you took them out and put them on wooden racks. You would move them from the bottom rack to the top rack and each day as you moved it up a rack and turned the cheeses they would develop a yeast, then develop a rind, and they would dry—it had the perfect environment to make that cheese.

The balance of the right microflora was just there and the climate was dry so you didn't have problems of high moisture. It was conducive to making a cheese that was relatively risk free—I'm sure the pH was relatively low and just right. The milk went right from the goat into the vat, almost being coagulated right then so there wasn't an issue of holding. Those cheeses were transported every two weeks to these little boutiques and restaurants and that was it. They were two weeks old or sometimes we'd sell them older, to a regular group of customers. No sales and marketing, no promotions, every two weeks you knew exactly what you were going to sell, exactly what you were doing; it was pretty idyllic.

DO YOU LOOK AT THE MARKET TODAY AND SEE TOOLS AND RESOURCES THAT YOU WISH WOULD HAVE BEEN AVAILABLE TO YOU THEN?

If I wanted to start my cheese business today, I would go into the marketplace and visit places and ask, "What sells? What's cool?" I'd do primary research and figure out what my niche was going to be.

Once the cheeses come out of their forms they are sprinkled with vegetable ash.

When we did it, American cheese was not a phenomenon, cheese making was not a vocation that anybody went into—it was weird. There was no place to buy equipment; you had to piece together things that existed for other types of cheese. You'd ask for a fermentation tank and the bankers and the welders would tell you that fermentation tanks aren't used for making cheese—you use a square vat to make Cheddar and you cook it and you need knives. We'd explain, "Well, this is sort of different." There was very little acceptance or enthusiasm in the trade for what we were doing. People would look at us and say, "These guys are clueless—we don't want to get involved with them, we're not going to get paid." The credibility barrier was huge beyond belief and as a woman? I mean *come on*.

Today you could go to Qualtech and they'll not only set you up with a cheese plant, they'll tell you how to make the cheese. In France they do that too.

THE MARKET HAS BECOME MUCH MORE COMPETITIVE. HOW HAVE YOU RESPONDED TO THAT?

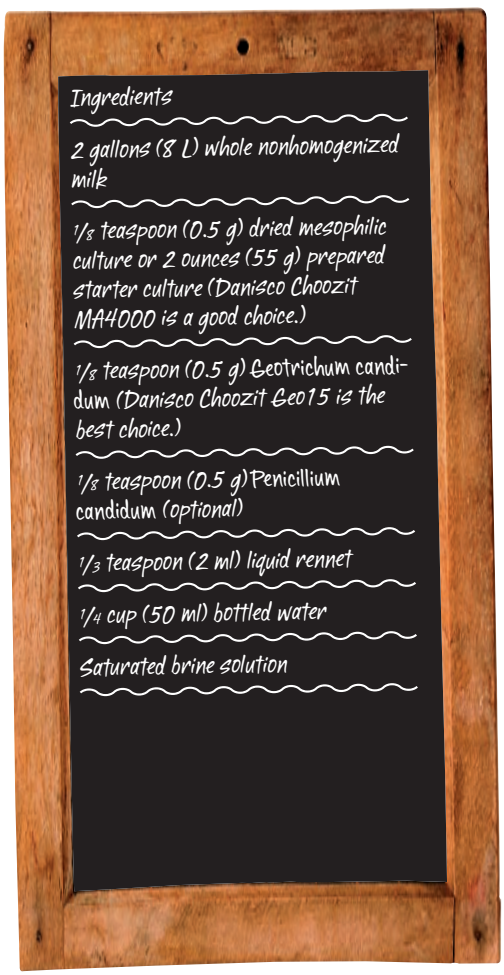
There is increased competition, but there's also an acceptance and awareness of an artisan, handmade cheese, American cheese, goat cheese. All of these things are so much more widespread that if you come to the market with a cheese, the chances of getting that sold or displacing another cheese are much better than coming to the market with a category that doesn't even exist. That is a much harder project.

I mean here we are making fromage blanc. Nobody eats that in the United States, nobody can say it—it's not a category. Then we make cultured butter and we see that everybody eats butter, everybody knows what it is. What we've done is taken an existing category and repositioned it on the high end of the market by doing some value-added thing to it. That was much easier. It is so different to sell a product that has some awareness. Being the first has its advantages; being the first in a non-existent market is much more difficult.

NEARLY THIRTY YEARS IN, HOW DO YOU STAY MOTIVATED?

I think that today versus the early years we have so many more resources to actually make the things that we want to make. So for those *Geotrichum* cheeses that we made in the Ardèche and Brittany—the Picodon, the little Crottin, Selles-sur-Cher, pyramid-type stuff that we made—we just couldn't do that in the early years. We didn't have the money to do it, we didn't have the expertise to do it, and we didn't have the market to do it.

Having twenty-seven years of business behind us, we've decided that we are experts in lactic curd cheeses—that's something that we do well. We are experts in butter, and we can continue to develop those categories. To me that's still exciting.



Crottin can be consumed while still young, like these, or allowed to age longer until they become slightly smaller and develop a denser texture.

CROTTIN

These small cheeses are the perfect size to open and finish in one sitting, and perhaps to share with a friend if you are feeling generous. To be made in their traditional size a tall round mold is used, usually about 2½" (6 cm) in diameter and 4½" (12 cm) high. These molds are filled to the brim with fresh curds that still contain a lot of moisture. During draining, whey will be released and the curds will shrink dramatically to about one-third of their original height.

If you want to cut down on the number of Crottin molds you will have to use to make the full recipe that follows, consider cutting the recipe in half. You can also use larger cheese molds, or make inexpensive homemade ones by punching holes with a small nail in empty plastic yogurt containers. Traditionally, Crottin uses *Geotrichum candidum* as its only secondary culture. This culture creates a wrinkled surface on the cheese that is often unappetizingly called "brainy." We optionally include *Penicillium candidum* as well in the recipe, which will give the cheese a fuzzy white mold surface and characteristics similar to brie or Camembert.

This recipe is based on information provided by Kris Noiseux.

PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Using two pots to create a water bath, heat the milk to 91°F (33°C).

3 Add the mesophilic culture, the *Geotrichum candidum*, and the *Penicillium candidum* (if using) and then stir. Ripen for 1 hour.

4 Dilute rennet in ¼ cup [50 ml] of water, add to milk and stir for one minute. Allow the mixture to coagulate for 1 hour and then check for a clean break. If the curd is not firm enough, allow it to coagulate for 10 more minutes and then check again.

5 Cut the curd to ½" (1.3 cm) cubes. Allow the curds to rest for 5 minutes.

6 Using clean, sanitized hands stir the curd gently 2 or 3 times over 10 minutes. Then let the curds rest without stirring for 10 minutes.

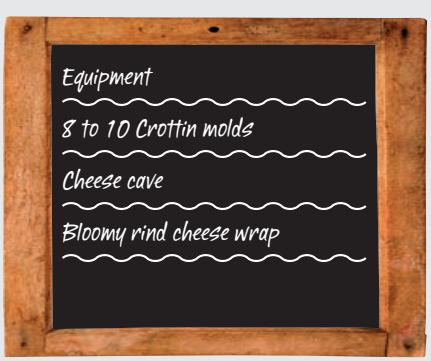
7 Scoop the curds into Crottin molds. Fill to the top of each mold **(A)**. The curds will compress quickly. After 5 minutes top off each mold with additional curd.

8 After 20 minutes flip the molds upside down onto a clean surface, then gently turn them over and replace them in the mold **(B)**. Flip one or two more times before allowing to drain overnight. If one side of the cheese looks a little more uneven than the other, have it on the bottom while draining overnight.

9 The next day the cheeses should have shrunk to one-fourth to one-third their original height. Unmold the cheeses and soak them in a saturated brine solution for 20 minutes, turning over the cheeses halfway through. Allow the cheeses to dry on a wire rack for 1 to 2 hours.

10 Place the cheeses on a bamboo mat or a draining mat and place in an aging environment of 55°F (13°C) and 80 percent relative humidity. Allow to age for 4 to 6 weeks, flipping every 3 to 4 days to prevent the surface from growing into the draining mat.

11 When aging is complete, wrap in bloomy rind cheese wrap and place in the refrigerator.



a Using your hands or a small ladle, fill Crottin molds to the top.

b Carefully remove cheese, flip it over, and place back in forms.

Head cheesemaker Maureen Cunnie poses at Cowgirl Creamery with their newest cheese, Wagon Wheel. Photo: Sarah Remington

MAUREEN CUNNIE,
CHEESEMAKER, COWGIRL CREAMERY, POINT REYES STATION, CALIFORNIA, USA

Driven by an urge to keep small dairy farms in business and preserve part of Northern California's agricultural landscape, Sue Conley and Peg Smith—Cowgirl Creamery founders—began transforming organic milk into artisan cheese in a small facility in foggy little Point Reyes Station in the late 1990s. Maureen Cunnie, a trained chef, joined them shortly thereafter and quickly took over as lead cheesemaker. She has worked with the team at Cowgirl over the past decade to produce cheeses that win awards everywhere they go.

DID YOU KNOW MUCH ABOUT CHEESE MAKING WHEN YOU STARTED?

I didn't know anything. I had called lots of cheesemakers around the country looking to apprentice or do an internship. I called Cowgirl Creamery, Sue answered the phone, and she said they were looking for a cheesemaker. I said I didn't know anything about cheese and she said, "That's okay. I'll teach you."

DID CHEESE MAKING SEEM SIMILAR TO WORKING IN A KITCHEN?

I didn't like the chaos of the kitchen, so I liked how it was really quiet and you could concentrate and how methodical cheese making was. There is also an aspect where you have to go with the flow; you're always waiting for the cheese. Those first couple years I was late everywhere I went because the cheese was controlling me more than I was controlling the cheese. You wait for it to culture, you wait for it to rennet, you wait for the pH to drop, you wait for the curd to get to the right consistency.

DO YOU USE A LOT OF SCIENCE IN CHEESE MAKING?

We do. Whenever we have problems—like why isn't this starter culture working or why is it working like this—we go back to the books and troubleshoot. There are so many experts now and everybody has their theory. Some always say it's sanitation or you're cutting the curd but the pH is too high, somebody else will say your salt content isn't correct, another will talk about the milk—your milk is too high in protein and fat so you need to add more culture. You have to look at all these different factors and whittle them down.

YOU'VE BEEN DOING IT FOR TEN YEARS. THAT MUST BE A NICE PLACE TO COME FROM WHEN YOU GET DIVERGING OPINIONS.

I think you have to look at everything one at a time. We had a period when we moved to Petaluma where we had to pull ourselves back in and really re-create the Mt. Tam.

JUST FROM CHANGING THE LOCATION?

It was a completely new creamery so we didn't have any slowdown or phage, meaning the cultures were really strong. We have more fluctuations with the temperature in Point Reyes; in the winter it gets very cold, so cultures slow down a lot, and in the summer it gets very hot, so they go really fast.

BLOOMY RIND AND WASHED RIND CHEESES SEEM LIKE RADICALLY DIFFERENT PRODUCTS. HOW DID COWGIRL END UP MAKING ONE OF EACH SO EARLY ON IN ITS BUSINESS?

I'm sure you know the story of the Red Hawk. We were aging Mt. Tam in the same room as other cheeses that had cheese mites, so the Mt. Tam got cheese mites. Back then we never threw anything out—we were only making about sixty Mt. Tams a week—and our perfect little Mt. Tam had cheese mites. What do you do when a cheese has cheese mites? You wash them.

We dunked them in hot water and brushed them off. It was the middle of winter and—Point Reyes in the winter is very humid and wet—they grew *B. linens* on them. So we took them to the farmers' market, gave them a different name, and sold them. The customers who bought them came back the next week asking for that cheese. So then it was a question of how to replicate what happened.

B. linens isn't an aggressive bacteria; it only grows in the right environment. It will only grow at a higher pH. *Penicillium* and *Geotrichum* raise the pH of the cheese so that the *B. linens* can grow. Washing cheese in salt water inhibits the growth of the *Penicillium* and the *Geotrichum* and creates this wet area that the *B. linens* can grow on. So you need the *Penicillium* and *Geotrichum* to start working first before the other ripening cultures can cultivate the rind.

IF YOU DON'T WASH THE CHEESE AND YOU'RE NOT CREATING A GREAT ENVIRONMENT FOR *B. LINENS*, DO YOU END UP WITH A MT. TAM?

Yes. However, if you have a Mt. Tam that is very high in moisture and the pH only drops down to 5.2, that cheese might develop *B. linens* on the rind. Just by the action of the pH of the rind rising, by the curd being of a higher pH, there's moisture escaping the cheese that the *B. linens* can grow on.

RED HAWK IS THE ONLY TRIPLE CREAM, WASHED RIND CHEESE THAT I KNOW OF. IS IT A CHALLENGING TYPE OF CHEESE TO MAKE?

It is. Jean d'Alos, a French affineur, said that in France they don't make washed rind cheeses with added cream; they make them with low-fat milk. Bitter peptides come through more with high fat, and that is a challenge to control *B. linens* and ripening so that it doesn't become bitter or overpowering. In the winter the Red Hawk is a much livelier cheese than it is in the summer.

BECAUSE OF SEASONAL VARIATIONS IN THE MILK YOU WORK WITH?

Yes. It's a little bit of a higher fat and a little bit of a softer fat, so it makes a softer cheese.

DOES WASHING THE CURD ADD A LEVEL OF DIFFICULTY IN DEVELOPING A WASHED RIND OR BLOOMY RIND?

I think the difficulty comes in people's expectations of the cheese. For instance, they always expect the Mt. Tam to be creamy and runny like brie, and it's not. It's never going to be soft and runny because it is a washed curd cheese; it will be firmer and the curd is a little bit cooked, a couple of degrees. A cheese that size or that shape will never get that runny because it is so tall.

Bloomy rinds are the perfect cheese—they're easy to do well and involve very few steps.

INSTEAD IT GETS SORT OF BUTTERY.
Right. The Red Hawk, depending on the season, can get creamy and runny, but it takes a long time for it to get that way. It's not going to happen in thirty days; it will be closer to forty-five to sixty days.

AND THAT'S A LONG TIME FOR A CHEESE THAT SIZE TO RIPEN?
It is, but that also gives us flexibility as a company. It has more strength as a cheese physically than, say, an Epoisses, because its shelf life is longer and there's not as much moisture in the cheese, so once it starts ripening it doesn't just take off—there's a little more work to happen.

AND THAT'S BECAUSE IT HAS LESS MOISTURE?
Less moisture in the cheese. The curds are washed, cooked, stirred, put in the forms, and then lightly pressed. Red Hawk is lightly pressed because it's put in cheesecloth and pressed by the cheese on top of it. Mt. Tam is not pressed.

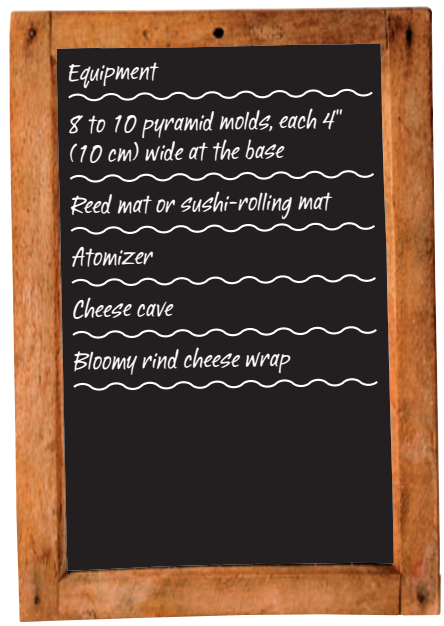
BLOOMY AND WASHED RIND CHEESES CAN BE CONSIDERED A LITTLE BIT RISKIER. WHAT DO YOU DO TO MITIGATE THOSE RISKS?
We clean a lot. When working in between batches we completely clean everything. We even clean between batches when we're turning cheese; we take off our gloves and use new sanitizer. We refresh our wash solution from batch to batch. Some people keep their morge and use it for one hundred years; we don't, it's a great way to keep that culture going, but it's also a great way to spread things around.

We brine our cheese and we have our brines tested weekly to make sure there is nothing growing in them. We don't want any pathogens. Brines at home would be easy to make and change; here we have thousands and thousands of gallons of brine, so that's hard to refresh.

The hardest part is right after making the cheese before the rind develops; that's when you're really at your highest risk because there is still so much moisture. The rind kind of protects the cheese and hinders some pathogens from growing. If I were a home cheesemaker I would definitely pasteurize, unless you're familiar with your milk source or you trust them.

IS THERE ANY TOOL THAT YOU HAVE FOUND TO BE VITALLY IMPORTANT IN CHEESE MAKING?
Fast-read thermometer. Instead of having something that takes twenty-five seconds, it takes five.

DO YOU THINK THAT BLOOMY RINDS OR WASHED RIND CHEESES ARE GOOD CHEESES FOR A HOME CHEESEMAKER TO START WITH?
I think bloomy rinds are the perfect cheese—they're easy to do well and involve very few steps. Washing you have to get in the rhythm of doing, so [the process] is a little bit harder. You may want to start with something like a bloomy and then move on to a washed rind once you're in the habit of turning the cheese at regular intervals. Making cheese is really easy; the hard part is aging it.



VALENÇAY

If you want to impress your friends with your homemade cheese, unwrap and slice into this uniquely shaped creation in front of them and show off its white and black layered rind, often with a semiliquid layer underneath. Counterintuitively, the make process is remarkably simple because there is no hovering over the pot for hours, stirring and monitoring temperature. Instead you let the milk coagulate over a couple of days at room temperature, scoop it into molds, drain, and age.

Coagulation occurs primarily due to the lactic acid produced by the starter cultures, rather than the enzymatic action of rennet. This gives the final cheese sharp acidic flavors in addition to the mushroom and occasional ammonia notes produced by the bloomy rind white mold. The curds produced by this lactic coagulation are very fragile and must be handled carefully to avoid breaking.

The pyramid shape that narrows at the top seems to prevent the fragile cheese from toppling under its own weight while aging. If you use a straight-sided mold, such as a Crottin mold, the cheese does not fare as well. You can reduce the number of pyramid or conical molds you will need by making only half a recipe.

Legend has it that Napolean cut off the top of this cheese in anger because it reminded him of the pyramids he saw on his campaign in Egypt. When making the cheese, you will realize that having the top cut off conveniently allows the cheesemaker to stand the mold upright while draining.

Goat's milk is the traditional milk for Valençay, but cow's milk works just as well. Do not use ultrapasteurized goat's milk as it does not coagulate well.

This recipe is adapted from a commercial recipe by Peter Dixon.

PROCEDURE

1 Sanitize all equipment that will come in contact with the milk or cheese.

2 Heat the milk gently to 72°F (22°C). (Using a water bath is not necessary.)

3 Add mesophilic culture and stir. Ripen for 30 minutes.

4 Dilute 2 drops of rennet in 1 teaspoon (5 ml) of bottled water. Add to milk and stir for 2 minutes.

5 Place the stockpot in a location where it will not be disturbed and the room temperature is between 68°F and 72°F (20°C and 22°C). Allow the milk to ripen and coagulate for 15 to 48 hours until a coagulated disk of curd pulls away from the sides of the pot and floats under about a ¼" (6 mm) of whey **(A)**. If the curd begins to crack, it is ready for draining. If using a pH meter, look for a pH of 4.5.

6 Drain the curd in a cheesecloth-lined colander for 2 to 4 hours.

7 Fill the pyramid molds with the drained curd. Allow the filled molds to drain for 1 to 2 days until the liquid released slows to a small trickle.

8 Unmold the cheese by turning the mold over onto a reed mat placed on a baking sheet with a lip **(B)**. The cheese will be very fragile, so handle it with care.

Using a small spoon, sprinkle kosher salt down the sides of the cheese. Coat the sides with as much salt as will stick to the moist surface without rolling off **(C)**.

Sprinkle ash on the cheese until the sides are just coated with a layer of solid black. Use a small spoon, pepper shaker, or jar with a perforated lid to apply the ash **(D)**.

9 Place the ash-covered cheeses in a cool location such as a basement and allow them to drain for 1 to 2 days. Quite a lot of whey will be released after the salt is applied, and the cheeses will shrink. Drain the whey off as necessary. While the cheese is draining, prepare the secondary cultures as described in the next step.

10 Mix 1/8 teaspoon (0.8 g) salt and 1/8 teaspoon (0.5 g) of sugar (in 8 ounces [200 ml] of water). In 4 ounces (100 ml) of this solution, dissolve 1/8 teaspoon (0.5 g) of *Geotrichum candidum* and 1/8 teaspoon (0.5 g) of *Penicillum candidum*. Allow this solution to sit in a refrigerator for at least 16 hours before use. Fill an atomizer with this solution in preparation for applying it to the cheese.

11 Spray the cheeses once with the solution of secondary cultures just enough to slightly moisten the sides. Move the drained cheeses to a cave at 55°F (13°C) and 80 percent relative humidity. Spray the cheeses again every other day for 6 days. After about 10 days, white mold should start to be visible. Continue to age for 3 to 6 weeks from when the cheeses were placed in the cave. Once the surface begins to deform slightly, the cheese is ready to be wrapped.

12 Once aging is complete, wrap the cheeses in bloomy rind cheese wrap and move them to a refrigerator.

In addition to being delicious, Valençay is a visually striking cheese with its fluffy white exterior hiding a bold line of dark vegetable ash beneath.

a The curd is ready when you can see it separate from the sides and float in the whey.

b Pick up the forms and gently jostle to get the cheeses to slide out; set them on the mat.

c Shake spoon, lofting salt onto the sides and over the top of the cheeses.

d Thoroughly coat cheeses with ash.

BLOOMY RIND CHEESES

Cheeses with white bloomy rinds are synonymous with indulgence for most because their textures are often gooey and creamy—but they don't have to be! We have been conditioned to think this because two of the most recognized bloomy rind cheeses in the world are brie and Camembert. *Penicillium* molds will grow on a cheese if given the right conditions, and although many of the cheeses bearing these rinds are designed to be luscious, some lean toward semifirm in texture.

A disk of Camembert with its slightly firm core surrounded by gooey paste demonstrates the aging pattern—from the rind toward the interior—of bloomy rind cheeses perfectly.

Cheerful orange rounds of Munster ripe for the tasting

WASHED-RIND OR SMEAR-RIPENED CHEESES

Often called "stinky" cheese, washed-rind cheeses tend to have pungent aromas and flavors. This style of cheese is easily identified by its appearance with rind colors ranging from pink to reddish orange. The cause for both the rind's hue and the telltale smell is the development of a specific type of bacteria on the rind. *Brevibacterium linens*, or *B. linens* for short, are the most commonly known bacteria that create this type of rind. *B. linens* are found throughout the natural world, including on the human body, which might be why we associate the aroma of washed-rind cheese with that of stinky socks!

Washed-rind or smear-ripened cheeses are made using similar techniques to those employed in making bloomy rind cheeses with one key difference: The pH is higher than that of bloomy rind cheeses throughout the production and aging process. The microbes that make up washed rinds are also better suited for a saline environment, and they prefer high moisture and high humidity. Cheeses are dry salted or soaked in brine following demolding, and then moved on to an aging room with high humidity (95 percent) and within the 52°F to 58°F (11°C to 14.5°C) range. *B. linens* or similar bacteria are then applied to the surface of the cheese via a wash, often a simple brine but possibly including beer, spirits, or herbs, that is applied to the rind with a cloth or brush.

Equipment

- Two 2-pound (1 kg) cheese molds
- Butter muslin cheesecloth
- Cheese paper, glassine paper (a.k.a. grease-proof paper), or tin foil for wrapping
- Cheese cave
- Plastic ripening container
- Plastic draining mat cut to size of ripening container

Ingredients

- 2 gallons (8 L) whole nonhomogenized milk, pasteurized
- 1/4 teaspoon (1 g) dried mesophilic culture or 4 ounces (120 ml) prepared starter culture (MM100 or similar)
- 1/8 teaspoon (0.5 g) B. linens culture, split into 2 portions
- 3/4 teaspoon (3.7 ml) 30 percent calcium chloride solution, diluted in 1/4 cup (60 ml) clean water
- 1/2 teaspoon (2.5 ml) liquid rennet
- 1/4 cup (50 ml) bottled water
- Saturated brine solution
- 1 ounce (30 g) noniodized salt for wash
- Wine/beer (optional)

The two-to-three-month aging period will try your patience, but this meaty, full-flavored cheese is worth the wait.

MUNSTER

Washed rind cheeses are perhaps one of the trickiest styles to produce and are not recommended for the novice. Even experienced, professional cheesemakers often have trouble making this style, so be prepared for a few failures. Consequently, you should feel quite proud of yourself when you produce a successful Munster that's stinky, soft, and delicious.

The *B. linens* bacteria, which give washed rind cheeses their smell, flavor, and characteristic orange rind, thrive in a high-humidity, high-salinity environment and require oxygen to grow. We create such an environment by using a sealable food-grade plastic container lined with a plastic draining mat. Large containers used for saving leftover food work well.

The *B. linens* bacteria are finicky, so we want to eliminate any microbiological competition by using pasteurized milk or by pasteurizing the milk ourselves. To pasteurize milk, heat it to 145°F (63°C), hold it 30 minutes, then cool it to the starting recipe temperature (90°F [32°C] in this case). It is important to complete heating in less than 30 minutes and to cool to the target temperature in less than 30 minutes. This is because dangerous bacteria could multiply and thrive in the milk while it is below pasteurization temperatures. Use a sink filled with ice water to cool the milk rapidly.

This recipe is based on information provided by Kris Noiseux.

PROCEDURE

1 Sanitize equipment that comes in contact with the milk or cheese.

2 Warm milk to 90°F (32°C) stirring gently. Add starter culture and half of the *B. linens* and mix well. Allow the milk to ripen for 15 minutes.

3 Mix the calcium chloride with ¼ cup (50 ml) of clean water, add to the milk, and mix well.

4 Mix the rennet in ¼ cup (50 ml) of bottled water and stir into milk for 2 minutes.

5 Maintain 90°F (32°C) and allow the milk to coagulate for 45 minutes or until a clean break is achieved.

6 Cut the curds into ½" (1.3 cm) pieces, then allow the curds to heal for 5 minutes.

7 Continue to maintain 90°F (32°C) for 30 minutes. Continue to stir to keep curds from matting.

8 Pour the curds into a cheesecloth-lined colander and allow them to drain for 10 minutes. Carefully ladle curds into the cheesecloth-lined molds. Be gentle as the curds will be very soft and delicate **(A)**. Fold the cheesecloth over the curds and cover with a follower to keep the top of the cheese flat.

9 Drain the cheese for 18 to 24 hours. Unwrap, rewrap, and flip the cheese after 1 hour, 2 hours, and then at least twice more during draining. The cheese should be firm enough to maintain its shape. If it starts to expand, put it back in the mold and drain for another 5 or 6 hours.

10 Brine the cheeses for 12 hours in saturated salt solution **(B)**. Flip it once halfway through the brining process. (See brining recipe, page 32).

11 Dissolve 1 ounce (30 g) of noniodized salt (about 5 teaspoons of pickling salt) in 1 quart (1 L) of water. Add the second half of the *B. linens*. Store this in a container that can be covered and is big enough in which to dip the cheese. You will use this solution to dip and wash the cheese during aging.

12 Place cheeses on a draining mat inside the ripening container. So air and oxygen are able to reach all sides of the cheese. Ripen for 2 weeks at 60°F (15.5°C) with the lid closed (the target humidity is 90 percent). Dip the cheese once a day in the wash prepared in step 11 for the first 3 days. Remove any whey or liquid from the ripening container and replace the cheese flipping it onto its opposite side. After 3 days of dipping, wipe the cheeses every other day with a cloth soaked in the same wash, flipping again when replacing **(C)**.

13 After 2 weeks open the lid of the ripening box slightly to allow some air exchange, and drop the temperature to 50°F (10°C). Continue to age until the surface is bright orange with *B. linens* growth. If mold appears, wipe it off with either a strong brine solution or the wash solution. You can optionally wash the rind with strong beer or sweet wine every 3 to 4 days at this point. Use a cloth soaked in the beer or wine or use an atomizer to mist the cheeses.

14 Once a bright orange coat is achieved, which may take 1 to 3 weeks longer, it is time to wrap the cheese **(D)**. Stop washing and open the lid to the plastic container. If the cheese looks moist, let it dry for 1 or 2 days in the cave. Wrap the cheeses in glassine paper, cheese paper, or tin foil **(E–H)**. Move to a standard refrigerator with a temperature near 38°F (3.5°C). Continue to age for a total aging time of 60 to 90 days. The cheese should have a soft pudgy interior when ready.

a Ladle curds into mold lined with cheesecloth.

e Place wheel in center of wrapping paper; pull opposing edges of paper together at center of wheel.

b Place cheese in a saturated brine solution once it has drained and can adequately hold its shape for 12 hours.

c Dip the wheel in the *B. Linens* solution for 3 days. Then wipe it every other day with cheesecloth soaked in the solution.

d Young wheels (bottom) will take on an orange hue (top) over 1 to 3 weeks.

f Double-fold gathered edges down toward center of the wheel.

g Press down on double-fold line along two edges of the wheel; begin to fold excess paper toward fold.

h With flaps of excess paper neatly folded toward one another, prepare to tuck under wheel and secure tucked edges with sticker or swatch of tape.

CHAPTER 12: AFFINAGE

Affinage is a French word that literally means "to refine." Within the realm of cheese this term is used to describe the period of aging, curing, or maturation that follows drainage of the curds. The types of things that happen during this time include desiccation (loss of moisture), proteolysis (breakdown of proteins), lipolysis (breakdown of fats), and the development of rinds, textures, and flavors. This is an incredibly active time in the life of a cheese, though the rate of activity varies considerably between cheese types. The speed and intensity of these processes is determined largely by the chemistry of the cheese—the amount of moisture, acidity, bacteria, and minerals within the cheese—and the temperature and humidity of the surrounding environment.

Effective affinage requires an awareness of activities happening to the cheese that are not always visible. There are cheeses that have been made for centuries and as a result carry a rich traditional knowledge that alleviates the demand for mastery of the chemistry. Newer cheeses require a more careful study of the chemistry that begins in the vat—possibly even in the pasture—and carries right on through to the apex of ripeness.

WHO DOES AFFINAGE?

The specific tasks that comprise affinage range from flipping and brushing cheeses to piercing, washing, and managing environmental conditions. Where artisan cheese is concerned, often it is the cheesemaker who conducts affinage. In areas where there is a rich tradition of cooperative cheese making, cheeses are often sold at a very young age to a company that specializes in affinage and also sells and distributes the cheese. Ideally professionals who possess expertise and training related to a specific cheese's needs bring that cheese to its peak and then deliver it to market.

Managing an inventory of a perishable product such as cheese is, simply put, a challenge. Retailers and distributors deal with problems in cheese quality on a daily basis as the result of shipping delays, temperature abuse, or overstock. Top retailers and distributors make every effort to create the best possible conditions and handling practices for each cheese that passes through their hands, and sometimes this means conducting affinage-like activities such as turning wheels or brushing rinds. These activities really fall under the category of cheese care more than affinage because, generally, they are done to mitigate damage rather than to achieve a distinct outcome through further maturation. A handful of retailers and distributors are also affineurs with proper facilities for ripening cheeses. Top businesses in this group are those that conduct affinage activities in some degree of partnership with the producer of the cheese to ensure the best and safest outcome.

Rows of cheeses neatly arranged in the aging room at Traders Point Creamery in Indiana

Mateo and Andy Kehler stand in front of the aging facility they built into a hillside on their farm in northeastern Vermont. Photo: ©2010 Ingalls Photo

MATEO KEHLER,
CO-OWNER, CELLARS AT JASPER HILL, CO-OWNER AND CHEESEMAKER, JASPER HILL FARM, GREENSBORO, VERMONT, USA

Mateo Kehler is a visionary who is often faced with what he calls "once-in-a-life-time-opportunities"; handily, his brother and business partner, Andy, has a knack for quietly mastering entire disciplines needed to keep up with their businesses. Rarely does anyone leave a discussion with them about their work without hearing the term *working landscape*. The forty-cow dairy at Jasper Hill Farm, the farmstead cheeses, and the 22,000-foot underground aging facility constructed on the farm in 2007 are all vehicles for their grand dream to revitalize the economy and landscape of Vermont's Northeast Kingdom, a region that holds great meaning to them and generations of their family.

We're interested in leaving a legacy, a footprint, on the landscape here in the form of a vibrant local dairy culture and economy, and that's really what we're building.

WHAT CONSTITUTES AFFINAGE?

Affinage denotes an active engagement with the ripening of a cheese, whereas aging cheese is passive. It is the act of deliberately, methodically, and consciously promoting rind and flavor development over a span of time in an effort to reveal the potential of a cheese.

ARE THERE CHEESES THAT JUST GET AGED?

There are lots of cheeses that just age—the obvious would be block, industrial cheese that gets put in a vacuum-sealed bag and on a shelf where it ages. You can age cheese for twenty years, but that cheese has not gone through the process of being ripened. It's just sitting there on a shelf.

WHY DID YOU AND YOUR BROTHER ANDY BUILD THE CELLARS?

We decided to build the Cellars because we had a once-in-a-lifetime opportunity with Cabot Clothbound to really do something on a scale that would change the way that the artisan cheese industry is organized in the U.S. We took our experience as a start-up farmstead cheesemaker as the basis for a business plan to try and address some of the challenges and lower the barriers to entry.

If we'd had somebody around that was going to buy our cheese right after we made it, ripen it in a facility so we didn't have to make the investment in capital construction, market and sell it so we didn't have to build a staff and a marketing and sales team, and then ship it to market so we didn't have to deal with the logistics and admin of getting a product to market and collecting money from customers, our whole experience in the beginning would have been much easier.

We're interested in leaving a legacy, a footprint, on the landscape here in the form of a vibrant local dairy culture and economy, and that's really what we're building. Cheese is just a vehicle to do that and the Cellars is a platform to reach that goal.

WHEN YOU STARTED THE CELLARS, IT OPENED YOU UP TO CHEESES MADE BY OTHER CHEESEMAKERS. DID THAT EXPOSURE AFFECT YOUR APPROACH TO AFFINAGE?

Absolutely. An affineur needs to be a better cheesemaker than the cheesemakers he or she is working with. All our challenges have come in addressing quality problems in production—the raw material, the water of the farms, and cheesemakers that we're working with. It's been a real challenge for cheesemakers to develop markets for these new products all at the same time.

We've had to take a step back and address the critical need for capacity building and technical development across our producer group in an effort to get the best quality cheese in the door because there's nothing that we can do to turn a donkey into a racehorse. It's really about the trajectory, and the trajectory of the cheese is established in the cheese vat, by the cheesemaker, and by the farmer producing the milk going into that cheese. We can provide the environment and the expertise to take care of the subtleties, ensuring that rind development is healthy and that the cheese is going to reach its full potential in terms of flavor and quality, but we can't take bad cheese and turn it into something delicious.

SO IT'S A TOTAL MYTH THAT YOU CAN SAVE CHEESES IN THE AGING ROOM.

You can mitigate, but that's the extent of it. A cheese that's not great coming into the aging room is never going to be great coming out.

MOST PEOPLE THINK ABOUT STARTING WITH A RECIPE AND MOVING FORWARD. SHOULD THEY BE STARTING WITH THE FINAL PRODUCT IDEA AND WORKING BACK TO THE RAW MATERIALS?

When I look at Jasper Hill Farm and the success that we've had as cheesemakers, I would say that by focusing intensely at the beginning on producing the highest possible quality milk, we averted untold tribulation in the start-up of our business. We worked with lots of other producers, did our homework, and we're quick learners, but the quality of our milk is the foundation of our products.

We started buying milk and we've had problems that we never had before because the problems oftentimes originate with the milk. While you can hone your skills as a cheesemaker over time, if the quality of your raw material isn't there, you're going to end up with bad cheese. There is not enough emphasis on understanding what good-quality cheese-making milk is. Affinage is just an extension of that process of making great milk, converting it into cheese—it's not separate.

ONCE YOU ARE PRODUCING HIGH-QUALITY MILK FOR CHEESE MAKING, CAN YOU CREATE CHALLENGES FOR YOURSELF BY NOT GOING WITH A CHEESE THAT IS THE BEST EXPRESSION OF YOUR MILK?

A lot of it comes down to feed and management; that can really have an impact on the cheese-making properties of a milk. We feed dry hay to our cows, not because you can't make great milk with silage-fed cattle, but the risks associated with making certain types of cheese are greater and we wanted to start off with a management and feed regime that would give us the most flexibility to make whatever kind of cheese we wanted. But if you're dealing with a confinement situation and you're feeding fermented feed, there's a range of cheeses that are going to be not impossible but very tricky.

One of the issues out there is that the tools for measuring milk quality don't really have a fine point. So just because you have a low count doesn't mean that you don't have a preponderance of a gas-forming bacteria that's going to cause your cheese to blow later. If you've got a thousand colony-forming units per millileter, which is a low number, but nine hundred of them are listeria, then you're going to have issues. If you're going to make a business out of it, you really need to understand your milk supply. In order to do that, you're going to need to develop a baseline understanding of what the microbial life in your raw material looks like, or pasteurize it—the nuclear option. There's always the nuclear option.

WHAT DO YOU NEED TO UNDERSTAND ABOUT A CHEESE TO CREATE A GOOD AFFINAGE PLAN FOR IT?

We've got different environments depending on what we're looking to see grow on the rinds. You're relying on "positive contamination" from the environment to feed and promote rind formation and development. Cheeses may start out getting washed for a time and then move into a cellar with a lot of native, wild molds in order to form more rustic rind after we've developed a population of coryneforms like *B. linens* in order to load up the rind with the enzymes that are going to produce flavor over time.

Understand where you want to end up and then work backward to determine what the aging regimen will be without locking yourself into a routine that dismisses the more immediate needs of a cheese or batch of cheeses for something different. Cheese making is an exercise in consciousness; it's about paying attention to a million little details over a very long time and knowing that not every batch of cheese is going to behave the same way. Having the understanding of what the microbes on the rind need, what you want to encourage or discourage, and using your environments to essentially select for the rind development you're looking for is an art.

DO YOU THINK THAT AT THIS POINT YOU ARE LEARNING THINGS IN THE CELLARS THAT INFLUENCE DECISION MAKING IN THE EARLIER STEPS OF CHEESE MAKING?

Absolutley. Our job is to give feedback to the cheesemakers and help them understand how to redirect their process if necessary to produce a cheese that's going to be more marketable, more delicious. The trajectory of a cheese is established in the cheese vat—the moisture and the salt, the pH evolution, all these things are established before the cheese even gets to the Cellars.

If a cheese [is] continuing to acidify after it goes into the Cellars, there are going to be problems with the affinage and there's nothing we can really do about that because that's the result of a production-related problem—not enough drainage. That cheese is going to behave differently than a cheese that has a stable pH as it moves into the cellars. That cheese with a stable pH is going to ripen in a more graceful and predictable way. We're continually communicating with cheesemakers in order to help produce cheeses that are going to mature gracefully.

DO YOU THINK ANYONE CAN DO AFFINAGE AT HOME?

Yes, absolutely. Not without some investment. But I think that there have been people making awesome cheeses for thousands of years. A lot of the cheese that's been made has probably been not that great—but is it possible? Definitely.

ARE THERE CHEESES THAT ARE SLIGHTLY EASIER TO MANAGE THROUGH AFFINAGE?

The extremes—hard-cooked pressed cheeses that don't require any significant nuanced aging, and fresh lactic cheeses [the opposite end of the spectrum] that are going to be consumed sooner and don't need the level of care and attention that you might have to put into those cheeses that fall into the middle ground.

WHAT ARE THE RISKS THAT SOMEONE NEW TO AFFINAGE SHOULD BE PARTICULARLY VIGILANT ABOUT?

Just as your milk is a pathway for contamination, your environment can also harbor pathogens and pose risks. Understanding the capacity of the cheese that you're working with to support the growth of pathogens—the available water, salt, pH, moisture content, all those things—are important in order to develop a risk management approach.

You don't want to make anybody sick. Have a working understanding of your raw material, good sanitation practices, and a means for verifying that your sanitation is working. We spend quite a bit of money every month monitoring our quality; there's quality that leads to deliciousness and then there's quality that leads to health and well-being. Both are equally important.

Mateo Kehler examines the rind of a small round of cheese made by one of the cheesemakers that sends their cheeses to the Cellars for aging.
Photo: ©2010 Ingalls Photo

Waxing can be an effective way to protect the face of a cut wheel of firm cheese for the home cheesemaker who can't go through a wheel as quickly as a retail shop would.

CHAPTER 13: SELECTING, HANDLING, AND STORING CHEESE

A tremendous amount of effort goes into making cheese—starting with the farmers carefully tending to their herds and producing the best possible milk, and carrying on through production and maturation. In many cases a cheese will spend as much time working its way to market—super or specialty—as it did being made and matured. There are many handoffs throughout the life of most cheeses, and the cheeses that are in the best condition in the marketplace are generally those that are either durable enough to withstand some abuse, or those that have been handled by well-informed professionals from the time they were made through to their consumption.

Beautifully made and matured cheeses can be damaged through temperature abuse, poor sanitation, improper cutting, and ineffective storage. Proper handling and care of cheese is not complicated, but it requires attention to detail and a certain degree of vigilance because cheeses are alive and what they need can change over time.

SELECTING CHEESE

It is so simple that it *almost* goes without saying that the easiest way to ensure you will enjoy a cheese is to taste it before you buy. Visual cues to look for when selecting cheese will be different depending on the type of cheese you're buying. Generally speaking, you want to avoid pieces of cheese that are cracked, either in the rind or the paste; this is a sign that the cheese is drying out and will not have the intended texture.

Cheeses that have been cut into small pieces and wrapped for ease of selling are more challenging to evaluate because you can't tell how long they have been sitting there. A cut piece of cheese has a lot of its interior surface area exposed, making it vulnerable to drying out, losing fats and thus flavor. Following are visual cues that will let you know a cheese is not in ideal condition.

- Graying directly beneath the rind (surface-ripened and blues)
- Oily appearance on cut surface (Tomme, alpine, Grana)
- Mold growth of any color on surface (fresh)
- Mold development on cut surface (all cheese types except blue)
- Dry or cracked spots (all cheese types)
- Dull brown hue on rind (surface-ripened)
- Liquid leaking from beneath rind (surface-ripened, washed rind)
- Persistent aroma of ammonia (all cheese types).

HANDLING CHEESE

First and foremost, be sure that your hands, cutting tools, and cutting surface are clean before you unwrap cheeses or bring them out of their aging environment. When preparing to cut or break down a piece or wheel of cheese, it is helpful to think all the way through to the shape of an individual piece before you dig in, much in the same way that you would read a recipe before commencing with the first step. The primary goal when breaking down any cheese is to finish with pieces that allow each taster to taste each part of the cheese from the center all the way out to the rind.

When presenting cheeses for tasting, cut at least a few portions so that tasters can see the proper way to cut each cheese and an appropriate portion size.

When cutting individual portions, remember:

Soft cheeses are best to cut while cold so they don't become sticky or runny.

Round cheeses are almost always best to cut into pie-shaped wedges. If working with larger wheels, the wedges can then be turned on their sides and sliced into triangle-shaped pieces.

Square cheeses should be cut in half on the diagonal or straight across and then into pie-shaped wedges.

Pyramids can be cut diagonally across the square on the top of the cheese then each half laid facedown and cut in half horizontally. The resulting pieces will be uneven (the top bit smaller than the bottom), but each will be easy to slice into pie-shaped wedges.

Hard, crumbly cheeses look and taste great when served as large crumbles—use a fork or knife to break up the paste into uneven chunks. These cheeses can also be shaved with a cheese planer.

Wheels with large diameters (over 8" [20 cm]) should be cut into pie-shaped wedges first, and then portions can be sliced off the nose of each pie wedge up until the wedge is short enough to be laid on its side and cut into manageable portions.

If you come across an unconventional shape, not to worry—simply try to cut pieces with even ratios of rind to paste.

Having the right tools is important when cutting cheeses. Many cheeses can be properly cut into portions using a combination of a chef's knife and a paring knife (for smaller cuts). A cheese wire or even a knife with holes in the blade will serve you better when working with soft cheeses because they have less surface area for the sticky cheese to attach to. Hard cheeses should be allowed to warm slightly before cutting. Scoring the rind with a small knife before cutting will also be helpful with harder wheels—it can also be useful with softer varieties, providing guidance for your cutting.

STORING CHEESE

Ideally a cheese is consumed shortly after it is cut; however, the size of wheels and appetites don't always mesh, and often some portion of the cheese needs to be stored. Although the refrigerator is a somewhat harsh environment compared to that of an aging room, because it is colder and there is more airflow, with proper protection the fridge is a great place to store cut cheeses. The bottom shelves, or better yet crisper drawers, in any refrigerator are going to be slightly warmer; the drawers especially will be less windy, making them a good cheese storage area. Both for sanitation reasons and the well-being of any cut cheese, it needs some kind of wrapping or protection. Plastic wrap, although readily available, doesn't allow cheese to breathe at all and can lead to the dying off of rinds and development of off-flavors and aromas. Wax or parchment paper can make a nice initial wrapping surrounded by a bit of loose plastic wrap to provide breathability and a bit of shelter.

There are a variety of cheese papers on the market, each designed for specific cheeses depending on their need for breathability. One of the more versatile types of cheese paper for cut cheeses is a two-layer paper where the inside layer is made of a porous plastic and the outer layer is a lightly waxed paper that allows oxygen exchange but keeps moisture in. If you are determined to use what you've got on hand, another viable solution is to keep cut pieces of cheese in plastic or glass containers with loose fitting lids; you want to avoid sealing the cheese in something because that creates the same lack of breathability as plastic wrap.

WRAPPING CHEESE

Cheese can be challenging to wrap because it doesn't come in box shapes very often, and that's what we're used to wrapping. Circles, pyramids, wedges, logs, and giant wheels—these are all potential shapes you will come across in the world of cheese. There are helpful techniques to get you through even the most difficult cheeses. Proper wrapping is an important aspect of effective cheese storage.

Cheeses available for sampling at a farmers' market

WRAPPING ROUND CHEESES: FRENCH-FOLD METHOD

This method of wrapping cheese is effective for nearly any shape and size of cheese. A tidily wrapped cheese makes for an attractive presentation and also protects the cheese from losing moisture. It is important to select a piece of paper that is large enough—this is easily tested by bringing two sides together across the top of the wheel or piece of cheese. If the sides don't overlap by at least 1" (2.5 cm), get a larger piece of paper.

PROCEDURE

1 Center the cheese on the paper **(A)**. For larger wheels you may need to tape together multiple sheets of paper.

2 Pull opposite sides of paper toward one another over the middle of the cheese **(B)**.

3 At the point where the sides meet, fold them together downward until they flatten against the top of the cheese **(C and D)**. Make sure there are at least two folds so the surface of the cheese is well protected.

4 Flatten out that fold across the wheel. Run fingers outward from the center along the fold until they bend the paper down the sides of the cheese **(E)**.

5 Fold paper on the sides inward to form triangles **(F and G)** that can then be tucked under the cheese and tacked with tape, or pulled up over the wheel and taped at the center **(H and I)**.

a Place round in center of paper.

b Bring opposite sides of paper together at centerline of round.

c Fold those edges down toward the wheel.

d Flatten out that fold across the wheel.

e Push down on the fold off one of the edges of the wheel.

f Fold one side inward on a diagonal.

g Repeat on other side to form a point.

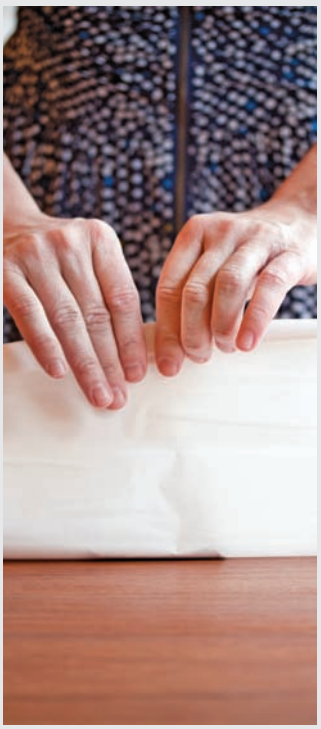
h Fold point up over the wheel edge and toward the center; secure with tape.

i Repeat on other side of wheel.

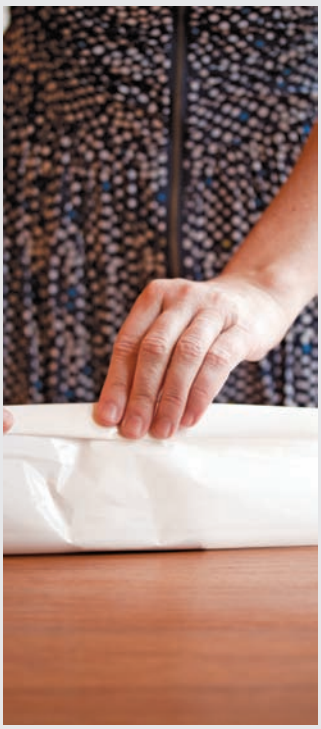
FRENCH-FOLD VARIATION: PYRAMID SHAPE

Pyramids are one of the most vexing shapes for cheese-wrapping novices. The near-universal French-fold method can be applied to this shape and will yield great results every time.

a Place pyramid in center of paper.



b Pull opposing edges of paper together over top of pyramid to meet.



c Fold that edge down toward the pyramid top.

PROCEDURE

1 Follow the French-Fold Method as you would for a round cheese **(A and B)**.

2 Fold the top edge down toward the pyramid top **(C)**. Follow fold with finger down one side of the pyramid **(D)**.

3 Fold both sides of the flap inward on the diagonal, making a point **(E)**.

4 Tuck point underneath the pyramid and repeat on the other side **(F)**.

d Follow fold with finger down one side of the pyramid.

e Fold both sides of flap inward on the diagonal, making a point.

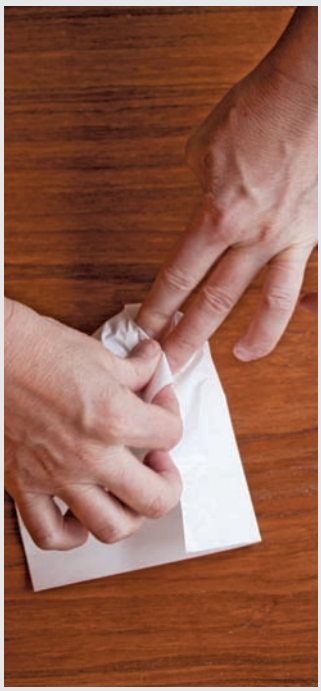
f Tuck point underneath the pyramid and repeat on the other side.

WRAPPING ROUND CHEESES: PINWHEEL METHOD

Round cheeses can also be wrapped in a pattern that looks like a pinwheel. Before you start, test the size of your paper by centering the cheese and folding up one side to see that it at least reaches the center of the round; if not, get a larger piece.

a Place round in the center of the paper.

b Fold one of the straight edges of paper toward the center of the round.



c Shift the round slightly to the right and fold overhanging paper in toward the center of the round.

PROCEDURE

1 Center the cheese on the paper **(A)**.

2 Pull paper from the center point of one side, folding it toward the center of the wheel. Hold the paper at the center point with your finger.

3 Take the excess paper immediately to the right of center and make an additional fold toward the center point of the cheese **(B)**.

4 Repeat this folding, moving in the same direction all the way around the wheel **(C and D)**.

5 When the final edge of paper has been folded into the center point, secure it with a piece of tape **(E)**.

d Continue working your way around the wheel.

e Once the final overhanging piece has been folded in, secure it with tape.

WRAPPING WEDGE: ENVELOPE METHOD

Wedges of cheese can be confounding to wrap neatly because every edge can be a different size. This is the most common shape of cut cheese that is purchased, and the simplest way to wrap it is to form the cheese paper into an envelope around it.

a Fold one of the side edges of the paper inward. It will fall at a slight diagonal because of the downward slope of the wedge.

b Repeat on other side of wedge, and fold resulting point up toward the wedge.

PROCEDURE

1. Position the wedge in the center of the paper.

2. Pick up one of the sides of paper aligned with the sloped edge of the cheese and fold it inward **(A)**. Repeat on the opposite side forming a slight point out from the narrowest edge of the wedge.

3. Fold point upward toward the wedge **(B)**.

4. Take the top corner of unfolded paper and fold it down toward the table. Repeat with other corner **(C)**. This will form another slight point that can be folded over the thick end of the wedge and secured with a piece of tape **(D)**.

c Fold remaining flaps inward and down toward the table to form another point.

d Pull pointed edge up and over the wedges and secure with tape.

Hervé Mons proudly displays cheeses from the Auvergne region of France.

HERVÉ MONS,
OWNER AND AFFINEUR, MONS FROMAGER/AFFINEUR, ROANNE, FRANCE

Mons Fromagerie/Affineur is a company name that has become synonymous with exemplary cheeses of France. Hervé Mons is a second-generation fromager and affineur; training under his parents and also with top fromagers in Paris, he has thrived in the industry for more than thirty years. Awarded Meilleur Ouvrier de France in his profession in 2000, he and his brother and business partner, Laurent, created a training center for future fromagers. Mons makes every effort to share his skills and expertise beyond France into the twenty-five-plus markets where he exports many of the traditional cheeses that were the foundation of his parents' business.

DOES A DIVISION OF LABOR BETWEEN CHEESE MAKING, AFFINAGE, AND RETAIL RESULT IN HIGHER QUALITY PRODUCTS?

It depends on the size of the company. When it is a small operation, everyone does everything and can more easily manage to do it right. When the company is bigger, you have to define specific roles for each person in order to be able to have better control over quality. For example, a small farm can control its production and distribution more easily than a bigger dairy that will need to define specific roles for everyone.

In both scenarios, communication between the persons will be key to lasting success and quality. For producers, they have to concentrate on the animals, the pastures, the milk quality, and the making. The affineur's role is to manage the aging, logistics, and retail. If each person does everything correctly with care, then it will lead to higher quality products.

WHEN YOU SELECT CHEESES TO WORK WITH, WHAT ARE YOU LOOKING FOR?

The global philosophy of the farm or cheesemaker and the general well-being of the animals, people, and products.

HOW MUCH ABOUT CHEESE MAKING DOES ONE NEED TO UNDERSTAND EVALUATE DEFECTS WITHIN CHEESE?

You need to know about the basics of cheese making and how acidification works as well as the differences in cheese-making techniques for different styles of cheeses. You also need to know about climate and its influences on the *terroir* because the *terroir* is reflected in the cheese.

YOU HAVE TASTED AND WORKED WITH TRADITIONAL CHEESES OF THE AUVERGNE REGION FOR YOUR ENTIRE LIFE. HOW IS YOUR EVALUATION OF THOSE CHEESES DIFFERENT FROM YOUR EVALUATION OF "NEW" CHEESES ENTERING THE MARKETPLACE?

The method to evaluate cheeses is the same whether it is "new" or "old": Taste/texture and quality are the main keys to evaluate all types of cheeses.

ARE THERE TYPES OF CHEESES THAT ARE MORE CHALLENGING TO EVALUATE THAN OTHERS?

The ones with no defects and with no typicity. Industrial cheeses, for example, or farmstead cheeses with no personality; those are the hardest ones to evaluate.

WHAT ARE SOME OF THE MAIN SENSORY CUES YOU LOOK FOR WHEN YOU WALK THROUGH YOUR CAVES?

Smell [ammonia], temperature, and humidity. Those elements are perceived by our natural senses and they are the main indicators to check.

DO YOU HAVE ANY RECOMMENDATIONS FOR AGING ROOMS?

Experience. Work with as many different affineurs as possible and with the best affineurs specializing in one product. This will allow you to understand each product properly.

WHAT IS THE ADVANTAGE OF DEVELOPING AN AGING FACILITY UNDERGROUND, AS YOU'VE DONE WITH THE LE TUNNEL DE LA COLLONGE?

Insulation. We have always had the instinct to dig to hide from the light and protect from temperature changes—to create caves and store products. The insulation coefficient and the protection of the soil help maintain humidity in the cave. Before, they didn't have all the tools we now have to control temperature and humidity, and getting underground was the best way to create an environment with controlled temp and humidity.

Certain cheeses like firm, semifirm, and some blue cheeses need that particular environment with natural material and underground atmosphere to encourage and develop particular rinds, flavor profiles, and textures that you can't develop with as much typicity in modern caves.

DO YOU HAVE RECOMMENDATIONS FOR CHEESEMAKERS WHO ARE TRYING TO FIGURE OUT THE RIGHT PACKAGING AND STORAGE FOR THEIR CHEESES?

Test different packaging. Different tests and trials in different kinds of situations, temperature, and transport need to be done in order to define what type of packaging will be the best for the cheese.

WHAT IS THE MOST COMMON DISAPPOINTMENTS YOU ENCOUNTER IN CHEESE SHOPS?

The quality of the cheeses in the shop and the lack of knowledge of the cheesemongers. And this is an international problem; it is the case in France as well.

IS PROPER HANDLING OF "FINISHED" CHEESE DIFFICULT?

It is not a very difficult thing to do, but you can't forget that the cheese is a living product. It needs continuous attention—even when in the cheese shop.

CAN A PERFECT CHEESE BE RUINED AT THE RETAIL LEVEL?

Yes. By not giving it the care it deserves, and by forgetting to sell it.

WHAT ASPECTS OF TRAINING FOR CHEESE RETAILERS SHOULD BE TAKEN MORE SERIOUSLY?

Adapting the volume and diversity of cheeses to the sales and not overstocking—thinking that the "mass effect" is attractive to customers. This method doesn't apply to all types of cheeses and is harmful for the turnover of the cheeses.

It is important to preserve the quality of the cheeses sold behind the counters.

YOU VISIT CHEESE SHOPS ALL OVER THE WORLD. WHAT IN THE RETAIL EXPERIENCE DO YOU THINK HAS IMPROVED IN THE PAST FIVE TO TEN YEARS?

I realize that nothing has changed. The success of a cheese counter happens mainly with the professionalism of the mongers.

It is not a question of money; we have seen too many companies investing big money in communication and marketing not getting the success they were expecting, and the reason is because the human factor [training and education] wasn't a priority.

IS IT REALLY IMPORTANT TO CUT CHEESES PROPERLY?

Of course. You need to avoid bad cuts to avoid loss, but it also shows respect to the product to cut it properly.

WHAT ABOUT WRAPPING CHEESE?

Same as above, very important. A well-wrapped cheese will keep longer and in better quality. Again, it shows respect to all the work that was done to make the cheese.

WHAT, IF ANYTHING, CONTINUES TO PIQUE YOUR CURIOSITY ABOUT CHEESE?

Being able to always offer the best products, at the best time.

Tasting cheeses alongside accompaniments such as olives, honey, and nuts can bring out or mask specific flavors, so be sure to taste cheeses on their own before delving into pairings.

CHAPTER 14: TASTING CHEESE

The good news about developing your palate for tasting cheese is that the only way to do it is by *tasting cheese*. While there are no hard-and-fast rules for progressing in the realm of taste, there are approaches that can make it less overwhelming. Whether learning as an aspiring professional or a burgeoning enthusiast, one of the best ways to begin is by tasting well-known cheeses that are widely available and noting what flavors and textures you observe. If you get stuck right out of the gate, start by identifying things that the cheese *doesn't* taste like to get your vocabulary flowing.

Once you've tasted a collection of the greats (not all at once, please!), those taste memories can be used as benchmarks during other tastings. One reason to start with these cheeses is that published descriptions of them should be easily found, and those may help you pick up some vocabulary words. The next step is to branch out to less familiar cheeses and start by thinking about them in comparison to the greats. Does this cheese taste like Gouda? If yes, what about it specifically reminds you of Gouda—the thick and clay-like texture, the caramel-like sweetness? Be sure to note similarities between the cheese and other foods too—even nonfood things that the aromas and flavors remind you of.

This method helps to establish a baseline vocabulary and reinforces memories of previous tastings because they are often being referenced during the tasting of new cheeses. Being able to accurately articulate textures and flavors will be incredibly helpful when shopping for cheeses—a way to ensure that you walk out of the store with something you will enjoy.

Aged Ossau-Iraty displays the most common flavor characteristics of aged sheep's milk cheeses—a bit of sweetness balanced by a hint of acidity and nutty notes.

TIPS FOR TASTING

Don't limit yourself to cheese-specific descriptions. Cheeses can taste like peanut butter and green onions or smell like Band-Aids.

Taste multiple cheeses at once. Trying three Cheddars side by side makes it possible to see more about each one than if they were tasted alone.

Taste with other people. This helps expand vocabulary and, if nothing else, it might make it more fun.

Apply yourself regularly. There is no substitute for just doing it, so get out there and taste more cheese.

CHRISTINE CHENARD,
DIRECTOR OF CONSUMER SENSORY RESEARCH, CINTECH, MONTREAL, QUÉBEC, CANADA

Christine Chenard, an enthusiastic advocate for every palate on the planet, encourages people to develop their ability to taste.

An expert in the rigors of purpose-driven sensory analysis, Christine Chenard has not lost any of her enthusiasm for the delights of tasting. Along with colleagues in her field, she is working to develop standardized techniques for sensory evaluation and encouraging people around the world to hone their sensory skills by paying closer attention to the aromas they experience every day.

WHAT IS THE DIFFERENCE BETWEEN TASTING AND SENSORY EVALUATION?

I was reading *Sensory Evaluation Techniques*, 3rd ed., a book by three well-known people in the sensory world, and in the introduction they explain that the term *organoleptic testing*, or sensory evaluation, emerged in the sixties and seventies. They wanted to differentiate their work, to separate themselves from the usual idea of tasting—the pleasure we get from tasting food—and to create a science. Sensory evaluation was more the scientific aspect of tasting food.

For me tasting is when you evaluate pleasure—when you have chocolate tasting, or wine tasting—it's really to have fun; you still can describe products, but it's more in a friendly manner than a well-standardized technique. Sensory evaluation is more for quality control and descriptive analysis.

HOW CAN TASTING POSSIBLY BE STANDARDIZED?

It's really difficult because we're not machines, we are humans, and there are a lot of differences among us in the way we perceive food. We have the same senses but for different reasons—cultural, sensibility, genetic—we are more sensitive to specific tastes than another person. On top of that there's the problem of vocabulary; we don't have a standardized vocabulary to describe food.

SENSORY EVALUATIONS SEEM CHALLENGING TO DESIGN BECAUSE ANSWERS FROM PARTICIPANTS ARE SO TIED TO THE QUESTIONS THAT YOU ASK.

Exactly. When we do evaluations we have to make sure that every individual is evaluating exactly the same thing. Sensory evaluation is a science and it's related to vocabulary. *Texture* is the worst because there are no specific descriptions; hard has a different meaning if you're talking about meat than if you're talking about candy or bread, but it's the same word.

You have to make sure that you have references to each and every word or each and every characteristic that you're evaluating to make sure that everyone is on the same page.

WHEN YOU GET SET UP TO DO AN EVALUATION, DO YOU PREPARE THE GROUP BY GIVING THEM BENCHMARKS OR REFERENCES?

It is much better if you are able to standardize the vocabulary. If we are talking about moisture absorption, the amount of saliva absorbed by products, we say one extreme would be crackers and the other would be a hard candy. Hard candy doesn't absorb anything whereas the crackers absorb everything, so crackers is a ten and a candy is a zero and everything else is in between.

There are standards that have been done, but people can make their own standards as long as the whole group that is evaluating agrees or accepts those references or uses the same references.

WHAT ARE SOME BASIC WAYS THAT AN INDIVIDUAL CAN DEVELOP HIS OR HER SKILLS IN THE AREA OF SENSORY EVALUATION OR OBSERVATIONS?

Take about five minutes every day to stop and take note of your surroundings and try to relate what you are smelling to something. It's the same as when you were a little kid and your parents showed you a triangle, a circle, and a square—they were different colors and you had to say the triangle is blue, the circle is green, and the square is red. Showing these to you and having you repeat 'This is a triangle, this is a circle . . .' you get used to that and accept this color is green, this color is blue, this color is red. It's the same thing with smells; you have to stop and remind yourself of what you are smelling.

Let's say you are cooking and you are putting spices into your meal. Smell the spices before you add them and remember: This is thyme, this is pepper, or these are different types of pepper, or these are different types of milk. There are different types of milk—cooked milk, fresh milk, cream. Smell everything. Stop for a few seconds and note that this is what you smell when you smell milk or butter. It's easy; it just requires discipline.

As humans we are able to smell more than ten thousand different smells, but we don't have words for every one of them. It's a matter of training—being interested, training, and vocabulary.

IN SENSORY EVALUATION, DO YOU ENCOURAGE PEOPLE TO USE WORDS THAT THEY KNOW OR TO TRY TO USE THE "INDUSTRY" WORDS THAT ARE USED TO DESCRIBE THOSE FOODS?

It depends on why they are doing the evaluation. If it's for marketing aspects and you want more vocabulary to describe the products and promote the products, I would let people use their own terms because it reminds them of something and that's how they will remember. When I do training for the food industry, I say to them if a word doesn't exist and you want to use it as long as everybody understands it, that's fine.

If you want to do quality control and there's a specific aspect that you really want people to understand, that something has to be standardized and that has to be understood by everybody.

IS THERE ONE ASPECT OF SENSORY EVALUATION WHERE PEOPLE HAVE THE MOST TROUBLE?

The most difficult thing is to put a word on what you smell and what you taste—it's vocabulary. It's hard because we're not trained to do that. As humans we are able to smell more than ten thousand different smells, but we don't have words for every one of them. It's a matter of training—being interested, training, and vocabulary.

DO YOU FOCUS MOSTLY ON HELPING PEOPLE TO IDENTIFY WHAT THEY ARE SENSING MORE THAN FIGURING OUT WHY THEY ARE SENSING IT?

I am more training them to put a word on what they perceive, not the why. I'm not a cheesemaker. We had this group a few years back of people who were experts in cheese making and other people who were really good at putting words on what they tasted or smelled; it was fun because we said what we tasted or smelled and they were able to relate that to something that happened during the production of the cheese.

Take the critical aspects of making cheese, like who made the cheese, the temperature of the milk, the age of the milk, the ingredients or quantity or quality of each ingredient you added, the temperature outside—any type of critical aspect that can influence cheese making—and then every time you do a production, evaluate, gather clues, and determine every time this thing happens, that happens too. You can link the two; every time we had half a degree in our milk we happened to smell or to taste that, or every time it's that employee our cheese is saltier.

HOW CAN SOMEONE LEARN ABOUT THINGS THEY ARE SENSITIVE TO OR DON'T TASTE SO THEY CAN ADJUST THEIR RESULTS ACCORDINGLY?

You have to do sensory evaluations with other people—I don't know any other way of doing that. There are some products on the market, little vials with aromas, and though most are linked to the wine industry, it still gives you a good approximation of whether you are good at smelling things. And if you do that with other people you can calibrate yourself against other people. Everybody is smelling or tasting the same thing at the same time, and you are able to evaluate if you are more or less sensitive than your colleague.

ARE THERE ANY TWO AROMAS OR FLAVORS THAT PEOPLE COMMONLY MIX UP?

Acidity and bitterness. Once we give them products that are bitter and products that are acid and we say this is acid, this is bitter—same thing as we said earlier with the triangles and the colors—then they are able to remember.

ARE THERE THINGS YOU RECOMMEND TO TASTE TO HELP THEM LEARN THE DIFFERENCE BETWEEN THE TWO?

Dark chocolate [90 percent cacao chocolate] and endives are really bitter, and those two are very good because they come from two different worlds—one is a vegetable and one is more of a seed. Pure caffeine is a really pure bitter.

What I give as an example of something acid is lemon. Then sour milk, it is really acid and it's dairy. Those two are really good examples of different acidity.

CHAPTER 15:
PAIRING CHEESE

If tasting is an introduction to how cheese plays on the palate, pairing is the process of determining how to make that experience play nicely once other flavors and aromas are introduced. Pairing is almost an expansion or extension of tasting because you learn how various flavors and textures elevate, destroy, or do nothing to other flavors and textures. Inevitably, this means that initially pairing is an exploration and requires a detective-like mind to tease apart interactions brought about by eating things together.

Mastery of pairing is actually mastery of taste and the ability to predict flavors and textures that will balance or improve one another. The catch, as always with subjective practices, is that everyone's palate is unique with its own set of sensitivities and sweet spots, so not all combinations will have universal appeal. On the upside, combining cheese with beverages and accompaniments of all kinds increases the universe of tasting exponentially.

Pairings don't have to be regimented or particularly formal—placing a large selection of labeled cheeses and wines out for participants invites them to explore the tasting at their own pace.

As the craft beer industry has expanded and evolved, beer has become a popular beverage in cheese pairings, offering a new palette of flavors and textures.

Max McCalman has conducted cheese tastings and educational pairings around the globe.

MAX McCALMAN, MAÎTRE FROMAGER AND AUTHOR, NEW YORK CITY, USA

Educator of the cheese-enthusiastic masses and some of the top cheese professionals in the U.S., Max McCalman entered into the cheese industry as America's first maître fromager more than fifteen years ago at New York's Picholine restaurant. Known to many in the business for his wine-and-cheese-pairing prowess, Max has expanded his teaching reach by authoring three information-rich cheese books since 2000. His latest tome, *Mastering Cheese: Lessons for Connoisseurship from a Maître Fromager*, is helping define the foundation of cheese knowledge needed by all involved in the business.

HOW DID YOU DEVELOP YOUR PALATE AND VOCABULARY FOR CHEESE?

I was a wine guy before I was a cheese guy—for fifteen years I went to tastings and events, learning about the nuances and varietals in different blends. When we opened the cheese program at Picholine in late 1994, I took the lexicon for wine descriptors and applied it to cheese. I was also able to use cheese as a platform to learn about the wines and vice versa. I have a pretty good nose and I don't smoke—I think that helps. It's the aroma that seals the deal.

WHAT INSPIRED THE FOCUS ON CHEESE AT PICHOLINE?

Terrance Brennan, chef and owner of Picholine, wanted tableside cheese trolley service. Tableside service like flambé and chateaubriande had already become passé in New York by the mid-'90s, but this was something new so it was like theater.

Terrance wanted to make sure—knowing that the cheese was not going to make a lot of money—that we sold a glass of port to go with each plate. A lot of people didn't want port; they were perfectly happy with their Cabernet Sauvignon, so this made me start to pay attention to the relationship of cheese to wine and try to extend that experience and make it pleasant.

HOW DID YOU GET PICKED TO BE THE FROMAGER?

It was probably because I had been in fine dining, and I had wine knowledge. No one could pay someone just to be the cheese guy. We thought waiters and captains would do the presentation, but they were too busy and they were disinterested. So I doubled the job of being maître d', fromager, part-time sommelier, working sixty hours a week or more partly because the reputation of the cheese program took off like a rocket. People came in and said, 'Those fourteen cheeses you had last week were fabulous. What do you have this week?' As it grew, people asked for cheeses I didn't have, so it behooved me to become an expert as quickly as possible and then to find good matches between the cheese and wine so that if we didn't sell a glass of port maybe I could recommend a cheese course that would go with whatever wine was left over.

WHAT SHOULD A PAIRING ACCOMPLISH?

There's one thing it should avoid: It should not be out of balance. The cheese should not overwhelm the wine—which happens more frequently than vice versa—or the beer or whatever it is. Because even the mildest cheeses make a large imprint on the palate and the cognitive receptors, I recommend that people have the wine first to get to know it on its own terms, then try the cheeses.

Look for the synergy between cheese and wine and look for that to elevate the cheese or the wine, or both, or bring out some nuances in the wine or the cheese or both that you didn't recognize to begin with.

AS BEER AND COCKTAILS HAVE EXPERIENCED A RENAISSANCE, HAVE YOU HAD TO DEVELOP YOUR PALATE FOR PAIRING CHEESE WITH THEM?

I think that what I've found in working with other beverages is that the vast range of relative successes that I have experienced with different kinds of wines is much wider—it's a bigger range of possibilities—than what I've found with beers from the lightest of lagers to chocolate porters.

Beer has a little bit of an advantage. It has effervescence, which lifts up the fat and acids left behind by the cheese, the beer and the combination. Also the pH level of beer is not quite as low as the pH levels of wine, so the pH levels are a bit more harmonious between cheese and beers.

HOW DO YOU HANDLE INQUIRIES ABOUT YOUR "FAVORITE" PAIRING OR "CORRECT" APPROACHES TO PAIRING?

I guess the older I get, the more accepting I am of conflicting ideas about successful matches and I think it's important because in more cases than not, cheese and wine or cheese and beer do work rather well and the disasters are far fewer than the successes. And that comes back to the best beverage you can put in your mouth by far is wine or beer and the best food bar none is cheese.

What makes the perfect pairing? If you're the one paying for the cheese and paying for the wine, just do your homework and buy what works for you. I think that too many people rely upon the importance of *terroir*. When I was looking for pairings, I looked for everything I could find in print on successful pairings and most of it directed people to cheeses and wines produced near each other, but there is so much that goes into cheese making and wine making that just because they came from the same place does not mean they are going to work well.

In my pairing system—plus two being a great match, negative two being a disaster—I make these quantifiable evaluations of pairings instead of writing out these long-handed notes of what was happening between the wine and the cheese. I enter all the plus ones, which are good but not great, and I don't include the zeroes or the negative ones or the negatives twos. Then I look for a statistical suggestion of a successful match so that I feel more comfortable recommending a range of cheeses with pinot noir for example. And I start to see that, to my palate at least, these styles of cheeses work pretty well with these styles of wines or beers or sakes or cognac.

HOW DO YOU RESPOND WHEN A CUSTOMER WHO DECLINES A CHEESE PLATE FOR DESSERT CITING CONCERNS ABOUT CHOLESTEROL THEN ORDERS THE CHOCOLATE CAKE?

These are the sorts of things that drove me to study nutritional values in cheese. I have a sweet tooth too, but I'd rather have my sweet in something that's good for me and I think that cheeses, even pasteurized cheeses, are good for me. I think that the biggest misconception about cheese is that it's an unhealthy food. Part of what has grown with cheese appreciation in the United States is a slowly growing recognition that it is derived from our first food, milk, and that is our only food for the first several weeks or months of our life, so it's got to be pretty good.

But it's happening very slowly because we're still up against a lot of people saying that it's fattening, that it's bad for your heart. Even within the cheese industry itself, it's still much maligned and it's had a bad rap for far too long. I've started to ask, "What is this food that we love and why does it have these addictive qualities? Why are my cholesterol levels not bad? Why don't I weigh 240 pounds?"

YOU MUST GET THAT QUESTION A LOT—YOU'RE QUITE FIT.

I do live in New York City, so I walk quite a bit, but I'm not getting the exercise I probably should for someone who spends so many hours in front of a desktop. This is an important message for the industry overall, not for the naysayser within the industry, but for everybody to be armed with as much knowledge about what cheese can do.

It's got three things going for it: It's made out of milk, it's got good acid development or it should, and it has a little salt—the great preservative.

MAX'S PAIRING PRINCIPLES

A veteran fromager with more than fifteen years of experience, Max McCalman looks for balancing and complementing relationships and has some principles of pairings that he applies to any beverage.

If you're hungry and thirsty, it will probably work.

We all have preferences—there's no right or wrong answer.

In more cases than not, cheese and wine work pretty well together.

Salty cheese goes well with the wines that are either a little sweet or have plenty of fruit to balance the salt in the cheese.

If the overall flavor, aroma, and texture profile of the wine and the cheese are in balance, the pairing will generally have a better finish.

More acidic or tart cheeses generally work better with more tart wines or beers.

Dessert wines have an advantage because they play off the savory qualities in cheeses.

It's the best and safest food you can put in your mouth.

If you're unsure about the water, drink the wine.

RESOURCES

INFORMATION

There are a number of helpful websites for home and small-scale commercial cheesemakers that offer advice and support.

ABIASA
Source of individual or mixed cultures
www.abiasa.com

AMERICAN CHEESE SOCIETY
Listings of cheese-making short courses and classified ads for equipment, apprenticeships, and educational opportunities
www.cheesesociety.org

CHEESE FORUM
Offers recipes, equipment, ingredient advice, and troubleshooting information
www.cheeseforum.org

DAIRY PRACTICES COUNCIL
Nonprofit organization offering detailed information on milk quality, sanitization, and regulations
www.dairypc.org

SMALL DAIRY
Classified listings of equipment, apprenticeships and internships, and resources for equipment and ingredients
www.smalldairy.com

SPECIALIST CHEESEMAKERS ASSOCIATION
Guide to best practices developed by cheesemakers, wholesalers, and retailers available for purchase on this site
www.specialistcheesemakers.co.uk

UNIVERSITY OF GUELPH, DEPARTMENT OF FOOD SCIENCE
Detailed explanations of the technical aspects of cheese making
www.foodsci.uoguelph.ca/cheese

INGREDIENT AND EQUIPMENT SUPPLIERS

Supplies for home cheese making are steadily becoming more widely available. Stores to consider contacting or visiting to see if they stock supplies include natural food stores, homebrewing supply outlets, and specialty cheese shops. These companies are wonderful sources for supplies and ingredients online.

CHEESE AND YOGURT MAKING
www.cheeseandyogurtmaking.com

THE CHEESEMAKER
www.thecheesemaker.com

CULTURES FOR HEALTH
www.culturesforhealth.com

DAIRY CONNECTION
www.dairyconnection.com

EXTECH INSTRUMENTS CORPORATION
www.extech.com

GLENGARRY CHEESEMAKING AND DAIRY SUPPLY
www.glengarrycheesemaking.on.ca

LEENERS
www.leeners.com

NEW ENGLAND CHEESEMAKING SUPPLY COMPANY
www.cheesemaking.com

URBAN CHEESECRAFT
www.urbancheesecraft.wordpress.com

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www.farmhousecheesemakers.com
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www.maxmccalman.com

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FROM SASHA

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FROM DAVID:

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ABOUT THE AUTHORS

SASHA DAVIES

Sasha Davies is an author and cheesemonger in Portland, Oregon. She started her cheese career in New York City as an apprentice in the cheese caves of Artisanal Premium Cheese, going on to manage the caves at Murray's Cheese, serve as a resident cheese expert for Marlow & Sons, and consult for cheese shops across the country. Sasha serves on the board of the American Cheese Society.

Her interest in cheese led her to embark on a tour of American cheesemakers, a project documented at www.cheesebyhand.com. Her first book is titled *The Guide to West Coast Cheese: More than 300 Cheeses Handcrafted in California, Oregon, and Washington* (Timber Press, 2010).

Davies has taught classes at the French Culinary Institute and the Cheese School of San Francisco. Other food writing by Davies has appeared in Portland's *Mix* magazine, the *Diner Journal*, and the cheese-focused magazine, *Culture*.

DAVID BLECKMANN

David Bleckmann is an obsessed home cheesemaker. Before cheese, he worked his way through other domestic culinary crafts including making beer and wine, making jam and other preserves, pickling, curing meat, and roasting coffee. An interest in learning how food is created and a fascination with food science led naturally to a desire to learn all about the art of turning liquid milk into solid cheese.

David teaches classes and writes freelance home cheese making articles, some of which can be found in the national magazine *Culture: The Word on Cheese*. David maintains a blog and hosts a hobby cheese making podcast at his website, joyofcheesemaking.com.

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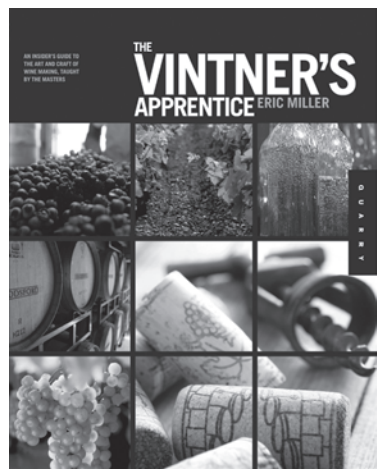

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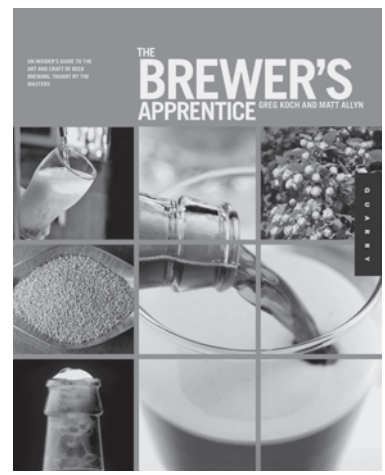

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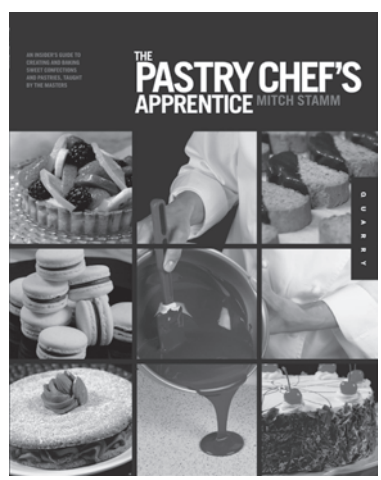

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TO ALL THE CHEESEMAKERS AND CHEESE PROFESSIONALS WHO HAVE INDULGED OUR INFINITE CURIOSITY ON THE SUBJECT OF CHEESE, CONTINUALLY SHARING THEIR KNOWLEDGE AND PASSION FOR THE SUBJECT AND TO THOSE WHO ARE SO FASCINATED BY HOW CHEESE IS MADE THAT THEY HAVE THE TENACITY TO LEARN HOW TO DO IT THEMSELVES.

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